

THE GENUS *PELECORHYNCHUS* (DIPTERA, TABANOIDEA).

By I. M. MACKERRAS, M.B., Ch.M., B.Sc., and the late MARY E. FULLER, B.Sc.

(Plate i; seventy-eight Text-figures.)

[Read 24th September, 1941; 25th March, 1942.*]

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1. Introduction.

A revision of the genus *Pelecorhynchus* has been contemplated for a long time, but has suffered many vicissitudes. It was commenced originally in 1926, in collaboration with the late Dr. E. W. Ferguson and Mr. G. H. Hardy, both of whom had to withdraw at a fairly early stage, the former owing to ill-health and the latter through pressure of other work. Thereafter it has been continued intermittently as opportunity has offered and material has accumulated. A fresh stimulus was brought to the work by Miss Fuller's discovery of the early stages, a discovery which was not made by chance, but was the result of long and characteristically thorough field investigations. She had completed those sections of the paper for which she was primarily responsible, and had reviewed the whole of the draft manuscript before her tragically sudden death. The final revision of the draft has been undertaken by the remaining author.

The history of this group of flies commenced in 1848, when Walker described three species (*personatus*, *eristaloides* and *fusciger*, all from Australia) and placed them doubtfully in the genus *Silvius*, later (1854) transferring them to *Dasybasis*. In 1850, Macquart erected the genus *Pelecorhynchus* (sometimes erroneously spelt *Pelecorrhynchus*) for *P. maculipennis* Macq. from Australia, which is now known to be identical with *Silvius personatus* Walker. In the same paper he described a Chilean species, *vulpes* Macq., as a *Pangonia*. The genus *Coenura* was proposed in 1857 by Bigot for *C. longicauda* Bigot from Chile, and in 1865 Philippi added four species of *Coenura*,

* Originally it was intended to publish this paper in two parts. The first part, pp. 9-38, was read on 24th September, 1941, and the second, pp. 38-76, was read on 25th March, 1942.

also from Chile. Schiner (1868) described *Coenura albopunctata* from Chile and added a synonym to the Australian *P. personatus* Walk., while Thomson (1868) erected the genus *Caenopnyga* for the same Australian species. Miss Ricardo in 1900 described two species of *Pelecorhynchus* from Chile, and in 1910 revised the genus, described additional species from Australia, and indicated the importance of the open anal cell, which she had added to the characters of the genus in 1900. Work in this country has been undertaken by White (1915), Taylor (1917, 1918, 1919), Ferguson (1921a, 1921b) and Hardy (1915, 1916, 1917, 1920, 1922, 1933, 1939, 1940), the last named publishing a revision bringing together all taxonomic information up to 1920, while his 1933 and 1939 papers have included most of the material which he brought to the collaboration mentioned above. Surcouf, in 1921, published a very incomplete revision, but gave a good description and figure of the male genitalia of *P. biguttatus* Phil. (*darwini* Ric.), which he repeated, together with a satisfactory definition of the genus, later in the year. In 1925, Enderlein raised the group to subfamily rank and included the two genera, *Pelecorhynchus* and *Coenura*. In the same year, Lindner described an additional species of *Coenura* from Chile. Finally, Kröber (1930) has revised the Chilean species, but followed Enderlein in placing them in the genus *Coenura*, and repeated Enderlein's erroneous characters for separating the two genera.

Thus, at the present time the group is recognized as a subfamily of the Tabanidae containing two genera, *Pelecorhynchus*, with seventeen species from Australia, and *Coenura*, with seven species from Chile. We now propose to raise the group to Family rank, but reduce the name *Coenura* to synonymy.

In this paper, we have endeavoured to examine the Family from three points of view: morphological, with its phylogenetic and zoogeographical implications; biological; and systematic. The general plan followed is that previously adopted by one of us in a revision of the Nemestrinidae (Mackerras, 1925), but on this occasion we have been fortunate in having an adequate series of the South American species for comparison, and doubly fortunate in being able to give a fairly complete account of the early stages.

Acknowledgments.

At the outset, we would gladly acknowledge the influence of our original collaborators, the late Dr. E. W. Ferguson and Mr. G. H. Hardy, in the development of the work, especially in the systematic section. Also, most of the morphological and systematic studies on the Australian species were completed while one of us (I.M.M.) held a Linnean Macleay Fellowship of the Society in Zoology. To Señor Carlos Stuardo O we are greatly indebted for the fine series of specimens on which our study of the South American species has been based. The Australian material examined comprised over five hundred specimens, chiefly from the collections of the original collaborators, but supplemented by a fine collection made at Barrington Tops, New South Wales, by the members of the late Professor Launcelot Harrison's expedition, and by the collections of Dr. A. J. Nicholson, Mr. G. M. Goldfinch, Mr. E. H. Kipps, the School of Public Health and Tropical Medicine, University of Sydney, Mr. A. L. Tonnoir, Dr. R. J. Tillyard and Mr. and Mrs. H. J. Willings. To Mr. Kipps we are also indebted for much help in the field work, and to Mr. W. J. James for the great pains he has taken to make the photographs as perfect as the material would permit. Finally, our gratitude is due to Dr. M. J. Mackerras for seeing the paper through the press when not one of the original authors was available to do so.

2. MORPHOLOGY.

A. THE ADULT.

The species of *Pelecorhynchus* are large to medium sized flies and are among the most ornate of the Tabanoidea, indeed, among the handsomest of all Diptera. Typically they are of stout, rather heavy build; but a few species are more slender and parallel-sided, and in those a tendency to resemble insects belonging to other orders is apparent. The thorax, and sometimes the abdomen, is covered with a velvety tomentum, and there are on various parts of the body, zones or tufts of silky hairs, which may be richly coloured, while the scutum, abdomen and wings may bear distinctively coloured patterns. Sexual dimorphism is usually not marked, the males in general being a little more

brightly coloured than the females, but in the *fulvus* group the patterns of the abdomen, and in one species, of the legs, are totally different in the two sexes, a degree of dimorphism that is very rare in the Diptera.

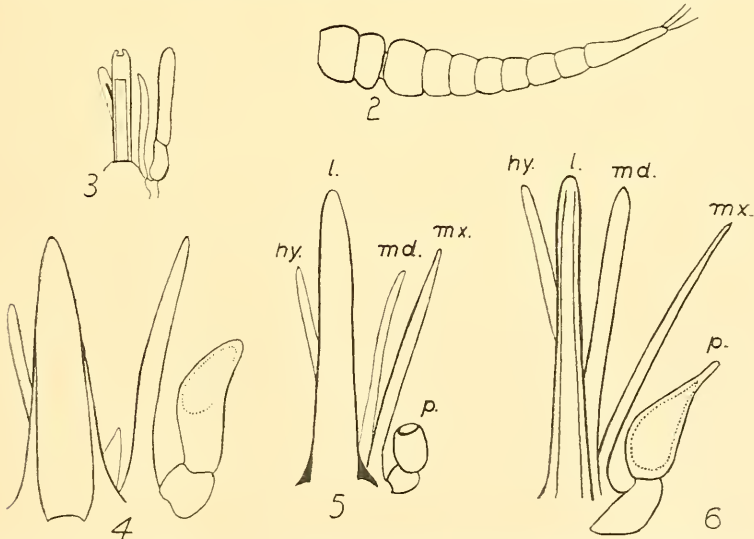


Text-fig. 1.—Lateral view of *P. fusconiger* Walk., female.

Head.

The head is large, usually as wide as the thorax, but sometimes definitely narrower. Seen from above, it forms an oval rather than the flattened ellipse of Tabanidae. The profile is also distinctive, since the face is strongly globose and the swelling continues practically to the mouth border, the clypeus being somewhat depressed (Text-fig. 1). The eyes are large, bare, uniformly dark brown, and the facets are subequal throughout in both sexes. In most species the eyes of the males are contiguous, but in *P. cristaloides* Walk. and *P. igniculus* Hardy they are narrowly separated, and in *P. fulvus* Ric. and *P. mirabilis* Tayl. they are quite widely separated. The eyes of the females are always well separated. Three typically placed ocelli are present.

The antennae (Text-fig. 2) are porrect and subulate. The two basal segments are short and cylindrical, and the third is elongate, gently tapering, and composed of eight distinct annuli, of which the first is the largest and the last is about twice as long as



Text-figs. 2-6.—2. Antenna of *P. fusconiger* Walk. 3. Mouthparts of *Atherimorpha vernalis* White, female. 4. Mouthparts of *P. longicaudus* Bigot, female. 5. Mouthparts of *P. distinctus* Tayl., female. 6. Mouthparts of *Sceptia patula* Walk., female. *hy.*, hypopharynx; *l.*, labrum; *md.*, mandible; *mx.*, maxilla; *p.*, palp.

those preceding it. The basal segments are haired, and the apex is surmounted by three or four short, fine hairs.

The proboscis is short. In *P. longicaudus* Bigot its length is less than half the head height, but in the other species it is only slightly less than the head height. It is unusually stout, and bears large, hatchet-shaped labella, the form of which has been remarked by most writers on the genus.

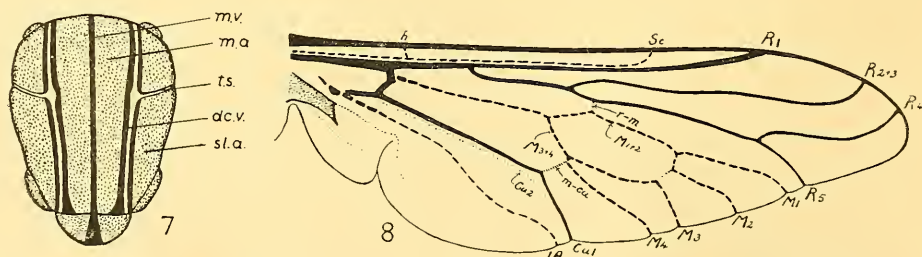
The proboscis arises far forward and is directed downward or somewhat backward, according to its position when the insect is killed. Though a movable organ, it does not appear to be capable of forward projection to any extent, unlike many Tabanidae, in which it may be extended in a line almost continuous with the long axis of the body. The most striking feature of the mouthparts is the reduction of the mandibles of the female. These organs are extremely small in *P. longicaudus* Bigot (Text-fig. 4), but in *P. elegans* Phil., also from Chile, and in the majority of the Australian species, they are of the form shown in Text-fig. 5. Occasionally, as in *P. fusconiger* Walk., they are slightly larger.

The palpi are very small and are similar in the sexes. The basal segment is minute, and the apical segment in the typical form (Text-fig. 5) is short, broadly cylindrical, and bears a shallow, wide-mouthed, apical pit. This sensory pit in some species tends to incline towards the lateral side and to become very shallow, while the palp itself becomes somewhat expanded. A further development is seen in *P. flavipennis* Ferg., the palpi of which have a definitely leaf-like form with a slight lateral concavity, and the culmination is reached in *P. longicaudus* Bigot (Text-fig. 4), which has palpi not unlike those of some species of *Scaptia*. The length of the palpi is usually about one-sixth of the proboscis, not one-third as stated by Enderlein.

On the head, the occipital pubescence is continuous round the sides with the beard and with similar hairs on the pronotal lobes, the propleura and the fore coxae. These combined areas of pubescence form a very distinct *ruff* surrounding the lateral and ventral aspects of the head and composed of densely arranged, long, silky, fine hairs (Text-fig. 1). The colouration of this ruff—white, yellow, crimson, etc.—is a valuable specific character.

Thorax.

The scutum is broad and rectangular. In most species it is nearly as broad as long, but in those of more slender build it is distinctly narrower. The transverse suture on each side ends medially at the dorso-central line, the median area being continuous. The disc is covered with dense, velvety tomentum, which may be absent from certain pale lines and areas. It also bears relatively sparse, short, fine hairs, usually black or brown in colour, but sometimes in part red. At the lateral margins, the pubescence is generally longer, denser and sometimes more brightly coloured, especially in the Chilean *P. elegans* Phil. In addition, there are two areas of especially dense pubescence—a *supra-alar tuft* and a *post-alar tuft*. The former consists of a zone of dense, often brightly coloured, but not very long hairs, and is prominent in the *fusconiger* series, the *elegans* series, and the *personatus* group, but not developed in the other species. The latter lies behind the post-alar callus and is always present, though it may not be



Text-fig. 7.—Generalized plan of scutal adornment. *dc.v.*, dorso-central vitta; *ma.*, median area; *mv.*, median vitta; *sl.a.*, sublateral area; *ts.*, transverse suture.

Text-fig. 8.—Wing of *P. fusconiger* Walk.

conspicuous. The scutellum bears marginal hairs, and a very distinctive silky tuft projects backwards from its ventral aspect. This, the *infra-scutellar tuft*, is characteristically coloured in certain species.

Besides the clothing just described, the scutum and scutellum bear a definite pattern, which differs considerably in the different species, but is reducible to a general scheme of colouration in the genus. Three areas are to be distinguished, a *median* and two *sublateral*. The three may be unicolorous, or the median may be coloured differently from the sublateral areas. In the middle of the median area, a longitudinal *median vitta* of different colour occurs in some species. Between the median and sublateral areas are placed the *dorso-central vittae* in the position of the row of dorso-central bristles in the Muscoidea. Fundamentally, the dorso-central vitta appears to be a dark stripe with a pale stripe superimposed, so that the pale stripe is bordered by a narrow dark line on each side. Great variations exist in the degree of development of the dark and light vittae and their relation to each other, and these variations appear to be constant within the species or, in some cases, subspecies. In *P. vulpes* Macq. all the lines are suppressed and the whole scutum is concolorous. A transverse, somewhat oblique line extends along the transverse suture from the dorso-central vittae towards the lateral margin. The scutellum may bear a median vitta, which may extend onto the scutum, or the margins may be darker than the disc. An imaginary generalized pattern, with all the lines developed, is shown in Text-fig. 7.

The upper part of the mesopleuron, just below and in front of the wing-root, forms a prominent convexity, with a rolled posterior margin separating it from the wing-root and the mesepimeron. Below, it is separated by a notch and groove from the sternopleuron, while dorso-anteriorly a further flat portion is also marked off by a groove. Anteriorly, a small propectus is recognizable and the pronotal lobes are well developed. The pleural pubescence is restricted to certain definite areas (Text-fig. 1). That on the pronotal lobes and propleura has already been recognized as taking part in the formation of the ruff. The mesopleural prominence is covered with fine hair of considerable length, but usually not of great density. Its posterior rolled edge bears a conspicuous, often brightly coloured, zone of long, dense, silky hairs. This zone is of considerable taxonomic importance, and will be termed the *post-mesopleural tuft*. There are also tufts of silky hairs on the squame, on the hypopleuron postero-ventral to the spiracle, and on a membranous fold which is situated ventro-laterally at the base of the abdomen.

Legs.

The legs are long and strong. This character, as in the Nemestrinid genus *Trichophthalma*, is probably associated with the flower haunting habits of the species, considerable strength being needed to cling to the waving blossoms of flowering shrubs even during moderate winds. The fore tibiae are unarmed, but the mid and hind bear paired apical spurs. The entire legs may be unicolorous, or the tibiae and tarsi may be sharply contrasted with the femora. In *P. distinctus* Tayl. the legs differ in colour in the sexes.

Wings.

The venation is shown in Text-fig. 8, Sc, the branches of M and 1A being for clarity shown by broken lines, as in a previous paper (Mackerras, 1925). We have adopted the interpretation of Tillyard (1919), but doubt whether the cubital area is correctly interpreted. It seems likely that the vein labelled M_1 should be $M_1 + Cu_{1A}$ and the distal section of Cu_1 be Cu_{1B} . The vein usually termed m-cu would thus become the basal section of Cu_{1A} . The venation is exceedingly primitive in all respects, with the single exception of the absence of the rudiment of the basal section of R_4 . This rudiment, which Alexander (1927) has shown to be the relic of a Nematocerous character, appears frequently in Tabanidae, but we have never seen it in a specimen of *Pelecorhynchus*. The open cubital cell (commonly known as the anal) and the sinuous vein 1A should especially be noted.

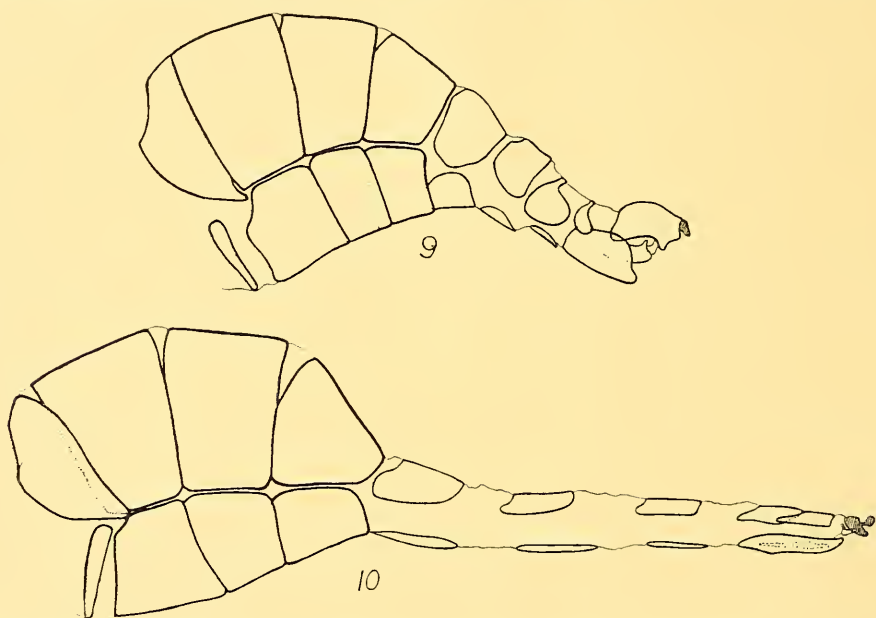
The wings may be uniformly tinted grey or yellow, or irregularly suffused with grey or yellow, or may be uniformly almost black, or again may show definite patterns of spots or bands of dark colour, frequently on a yellow ground. Some individual variation may be shown in the number of spots, but the general scheme of wing colouration is

constant within the species. In *P. fulvus* Ric. the wings are of a deep reddish-orange colour, with darker markings at the apex.

The squames of all species are extremely small, but show the usual division into superior movable and inferior fixed parts. The halteres, which are quite long, are usually hidden by the hair tuft which arises from the squame, but they may occasionally be conspicuous, as in *P. longicaudus* Bigot.

Abdomen.

The abdomen may be rounded, short conical, or more elongate and parallel-sided. The general relations of the segments are shown in Text-figs. 9 and 10 and will be dealt with further in the descriptions of the male and female genitalia, but the definite development of segment 1 may be especially noted. The abdomen may be bare and shiny or more or less completely covered with velvety tomentum. The hairs on the tergites are not conspicuous, except at the lateral margins, where they are long, dense and sometimes brightly coloured. The hairs at the apical edge of the fourth and fifth tergites may be longer and more prominent than on the disc.



Text-figs. 9 and 10.—Lateral view of abdomen of *P. fusconiger* Walk., showing relation of tergites and sternites. 9. Male. Specimen somewhat flattened. 10. Female.

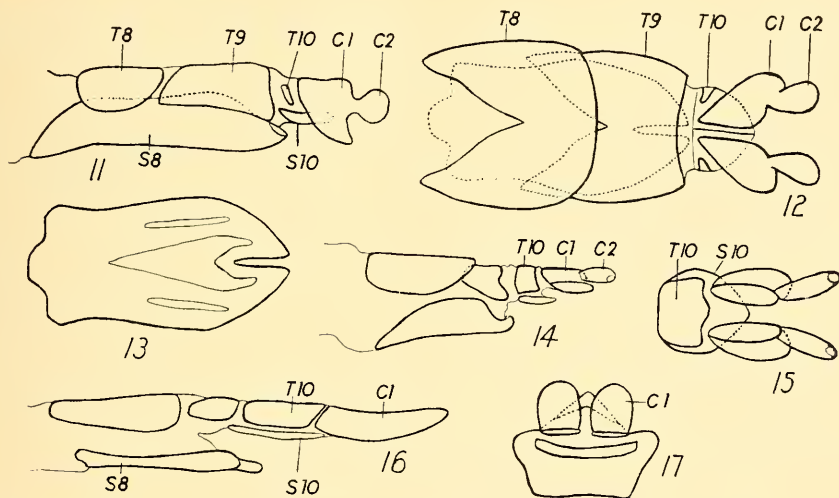
In those species in which the abdomen is tomentose, there are three distinct types of pattern. In the first type, there are white tomentose spots, developing into fasciae on the fourth segment and venter. In this type, which is characteristic of the Chilean species, a gradation may be traced from the bare *fusconiger* type, through the faintly marked *P. longicaudus* Bigot to the conspicuously adorned *P. elegans* Phil. The male of the Australian *P. mirabilis* Tayl. also belongs here. By a parallel line of development, the fasciate and sometimes vittate abdomen of *P. personatus* Walk. and its allies has been evolved, the pattern here taking the form of dark markings on a dull whitish or greyish ground colour. A third line of evolution is represented by the females of *P. fulvus* Ric. and allied species, in which the abdomen is rich orange in colour and adorned with black vittae. These differences in abdominal markings may be used to divide the genus into groups of related species.

Female Genitalia.

The correct interpretation of the terminal segments in the Diptera has always been difficult. Their relationships are, however, shown with unusual clarity by the females of

the more primitive Tabanoidea, and may therefore be discussed here rather than in the next Section.

In all these forms, the last six segments are greatly reduced in size. Tergites 5, 6, and 7 are more or less rectangular in shape, and the sternites form elongate, narrow bars. The tergites are relatively lightly chitinized and the inter-segmental membrane is greatly developed, the whole of these segments forming a long, tubular ovipositor, which is capable of considerable extension, but which in many specimens is almost completely withdrawn into the abdomen, only the cerci being clearly visible. There is no evidence of twisting. The eighth and ninth tergites are strongly chitinized and shield-like (Text-fig. 11), and underlying them is a single elongate, shovel-shaped, apically cleft sternite (Text-figs. 11-13). This we regard as the eighth sternite on account of its close resemblance to the undoubted eighth sternite of *Chorista* (Mecoptera), although it may possibly represent the fused eighth *plus* ninth sternites. In any case, there is no trace of a separate ninth sternite in the female. Immediately dorsal to the eighth sternite lies a lightly chitinized, forked structure, which we believe to be the genital fork, an endoskeletal element, and lateral to it on each side is a chitinous rod, apparently for the attachment of muscles (Text-fig. 13). None of these structures seems to correspond to the missing ninth sternite.



Text-figures 11-17.—Terminal segments of females. 11. Lateral view of *P. rubidus*, n. sp. 12. Dorsal view of *P. fusconiger* Walk. 13. Eighth sternite of *P. fusconiger* Walk., as seen from above in dissected specimen. 14. Lateral view of *Atherimorpha vernalis* White. 15. Dorsal view of same. 16. Lateral view of *Trichophthalma rufonigra* Mack. 17. Dorsal view of *Scaptia auriflua* Don. C1, C2, 1st and 2nd segments of cercus; S8, S10, sternites 8 and 10; T8, T9, T10, tergites 8, 9 and 10.

The arrangement of the tenth segment is best seen in the Rhagionid, *Atherimorpha vernalis* White (Text-figs. 14 and 15). The sternite is dark, rather soft, and triangular in shape, while the tergite is a definitely chitinized, strongly arched plate. The form of the sternite is very similar throughout the group, the anus being situated, either distally, or ventrally between the halves of the more or less divided sternite; but the development of the tergite varies considerably in the different families. In *Trichophthalma* (Nemestrinidae: Text-fig. 16) it is even better developed than in *Atherimorpha*, but in the primitive Stratiomyiidae, *Chiromyza* and *Neoexaireta*, it is relatively narrow, and in *Pelecorhynchus* it is reduced to a small chitinized patch in the membrane on each side (Text-figs. 11 and 12). In the Tabanidae, as in some of the more specialized members of other families, the terminal segments are dorso-ventrally compressed, and the tenth tergite takes the form of a narrow, transverse bar (Text-fig. 17).

Distal to the tenth segment, and attached more to the tergite than the sternite, are the paired cerci. The basal segment is typically tubular in *Neoezairaeta*, just as in many Mecoptera, but in *Chiromyza* it is tending to become broader, broader still in *Atherimorpha*, and broadest of all in *Pelecorhynchus*, in which it forms a soft, triangular structure hardly recognizable as appendiculate in origin. In *Atherimorpha*, the primitive Stratiomyidae, *Coenomyia*, and *Pelecorhynchus*, there is a second, apical segment (usually tubular, but pear-shaped in *Pelecorhynchus*), whereas the more specialized groups have one-segmented cerci. In the Nemestrinidae, for example, they form a long, conspicuous organ (Text-fig. 16), heavily chitinized in some genera,* whereas in the Tabanidae, they appear as a pair of small, soft, rounded, more or less transversely arranged flaps at the end of the abdomen (Text-fig. 17). Their study in other families should prove of considerable use in elucidating homologies.

Enderlein (1925) has described certain creases in the tergites of the ovipositor, and has used them for distinguishing the genera of Pelecorhynchinae. Various creases and folds may often be seen, but they are due to shrinkage, and are not constant in occurrence nor in position when they do occur. The form of the cerci is the most characteristic feature of the genus.

Male genitalia.

Surcouf (1921a) described and figured the Chilean *P. biguttatus* Phil. We have used for illustration *P. distinctus* Tayl., a generalized Australian type of which we had abundant material, while *P. longicaudus* Bigot, which is the genotype of *Coenura* and which is closely related to *P. biguttatus* Phil., is figured in Text-figures 74, 77 and 78. The genitalia of *Scaptia auriflua* Don. (Tabanidae) and *Chrysopilus aequalis* Walk. (Rhagionidae) are also figured for comparison. In the description that follows, the terminology used by Surcouf is placed in brackets.

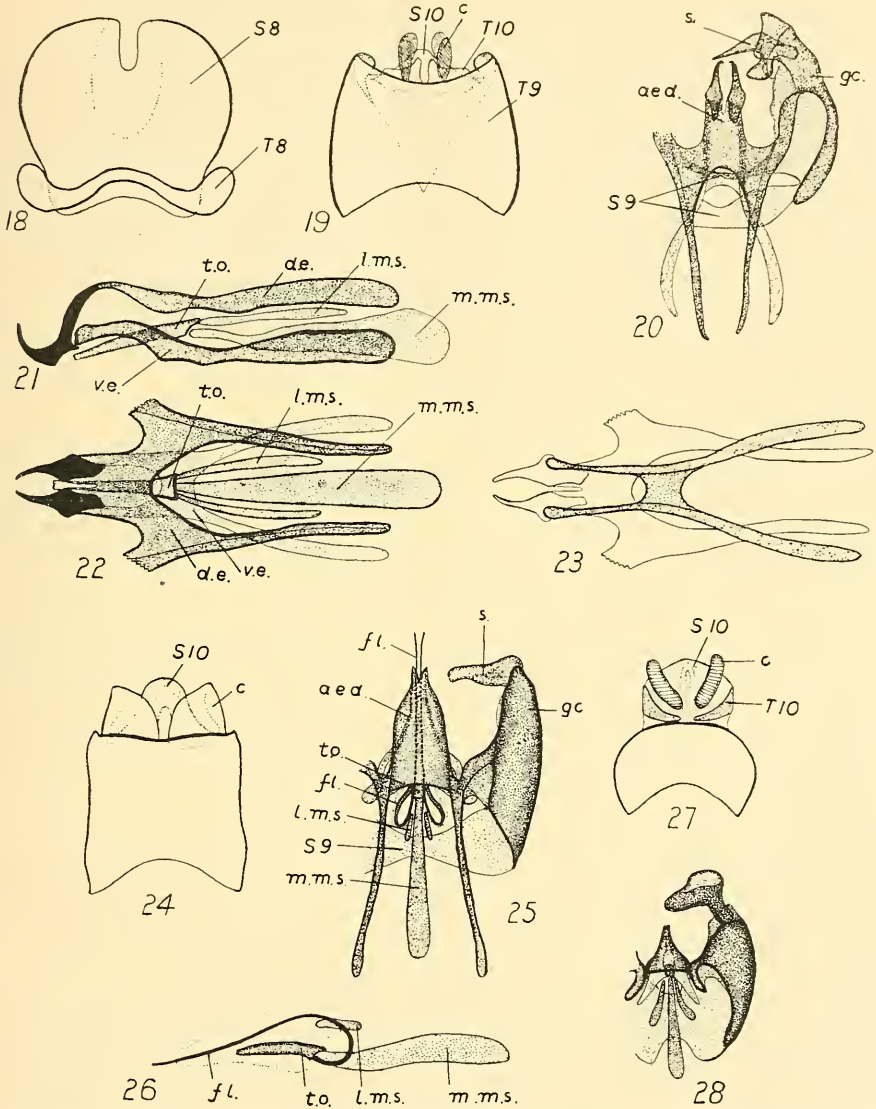
The genitalia of *Pelecorhynchus* are more prominent than in related groups. The fifth and following segments of the abdomen show a progressive reduction, and the eighth tergite consists merely of a narrow transverse bar which broadens laterally (Text-figs. 9, 18). All these parts are retracted into the abdomen, and are invisible in the living insect. The ninth tergite and eighth sternite are large and shield-like, the latter corresponding exactly to the same sclerite in the female. Together they form a globular swelling, open posteriorly, with the cerci and tips of the clasping organs visible between them. The parts enclosed by these two shields consist of the tenth segment and cerci dorsally, and the ninth sternite and gonocoxites, between which lies the aedeagus, ventrally.

The ninth tergite (*partie basilaire des lamelles externes*) is large, rectangular in shape when seen from above, heavily chitinized, and strongly arched so as to enclose the clasping organs at the sides as well as above (Text-fig. 9). Its lateral margin is somewhat sinuous and bears a rounded projection, while its distal margin is more or less excavated. The tenth segment is difficult to see, being but lightly chitinized; the tergite apparently forms a narrow transverse bar of peculiar shape (Text-fig. 19), while the sternite (*pièce intermédiaire des lamelles externes*) is larger, softer, not unlike that of the female, and extends distally as a rounded median lobe. The cerci (*lamelles externes*), which were termed "anal lobes" in a previous paper (Mackerras, 1925), are one-segmented, membranous, deeply pigmented, and much more prominent than the adjacent parts. These are often looked upon as the divided tenth tergite, but a study of the female and of such genera as *Chrysopilus* (Text-fig. 27), in which the relations of the structures are clearer, leaves no doubt of their true homologies. Surcouf does not mention the tenth tergite at all.

The ninth sternite is well developed and consists of strongly chitinized proximal and distal parts with a more or less transparent zone between (Text-fig. 20); the distal chitinized edge may be evenly concave, or it may bulge strongly distally, as in *P. fulvus* Ric. and *P. mirabilis* Tayl. The gonocoxites (*partie basilaire des lamelles internes*) are large and evenly curved, their lateral edges forming with the proximal edge of the ninth sternite an evenly rounded, horseshoe-shaped curve, not three sides of a square as in Tabanidae. The dorsal surface of the gonocoxite is deeply incised proximally, gives

* Referred to in a previous paper (Mackerras, 1925) as the lamellae of the ovipositor.

attachment to the aedeagus medially, and is produced further than the ventral surface distally, where it overhangs the style in the form of a hood (*P. distinctus* Tayl.), or of a long pointed process (*P. fusconiger* Walk.), or of a rounded lobe (*P. personatus* Walk. and others). Laterally, between the dorsal and ventral prolongations of its distal end, there is a more or less well-marked notch in the gonocoxite. The style (*partie apicale des lamelles internes*), often known as the dististyle, is well developed and presents



Text-figs. 18-23.—Male genitalia of *P. distinctus* Tayl. 18. Eighth tergite and sternite. 19. Ninth tergite, tenth segment and cerci. 20. Ninth sternite, clasper organs, and aedeagus, dorsal view. 21. Aedeagus, lateral view. 22. Aedeagus, dorsal view. 23. Aedeagus, ventral view.

Text-figs. 24-26.—Male genitalia of *Scaptia auriflua* Don. (Tabanidae). 24. Ninth tergite, tenth sternite, and cerci. 25. Dorsal view of aedeagus and clasper organs. 26. Lateral, sectional view of aedeagus.

Text-figs. 27-28.—*Chrysopilus aequalis* Walk. 27. Ninth tergite, tenth segment, and cerci. 28. Aedeagus and clasper organs. *aed.*, aedeagus; *c.*, cercus; *d.e.*, dorsal element; *fl.*, flagellum; *gc.*, gonocoxite; *l.ms.*, lateral muscle strut; *m.ms.*, medial muscle strut; *s.*, style; *t.o.*, transmitting organ; *v.e.*, ventral element. S8, S9, S10, sternites 8-10; T8, T9, T10, tergites 8-10.

three lobes for examination, a lateral, which is the longest and most prominent, a medial, which is shorter and usually has the form of a rounded salience, and an intermediate, which is usually the smallest and which lies between and ventral to the other two; the intermediate lobe may be partly amalgamated with the medial. The terminology here adopted is based on the true morphological position of the style, i.e., in line with the gonocoxite; in the mounted specimen, it is always bent in more or less at a right angle to the gonocoxite, and the lateral lobe is distal in position, while the medial lobe is proximal.

The aedeagus (*capuchon du pénis*) consists of distinct dorsal and ventral elements. The dorsal element (Text-figs. 21, 22, *d.e.*) consists of a broad, flat plate, which is attached laterally to the gonocoxites, and produced proximally into a stout strut on each side for the attachment of muscles, while distally it is continuous with two heavily chitinized, pointed processes, which are typically formed into strong upturned hooks as shown in Text-fig. 21. Medially, each heavily chitinized hook usually bears a small tooth, proximal to which the space between the hooks is often expanded (cf. *P. fusconiger* Walk., Text-fig. 63). The ventral element is H-shaped (Text-fig. 23), and is articulated to the base of the heavily chitinized hooks of the dorsal process; throughout the remainder of its extent it is only joined to the dorsal element by membrane. The proximal limbs of the H form long processes for the attachment of muscles, similar to those of the dorsal element. The membranous part between the limbs is often rather prominent and forms, with the proximal limbs of the H, the horseshoe-shaped structure seen by Surcouf, who did not make out the distal connections of the ventral element.

The transmitting organ or penis (*partie apicale du pénis*) lies between the elements of the aedeagus and is directed somewhat ventrally in its distal part. It consists of a chitinous tube, which is somewhat expanded proximally, where it gives attachment to a large median strut (*partie basilaire du pénis*) and two smaller but fairly long lateral struts (*guide du pénis, appareil rétracteur*). There is no trace whatever of the flagella (*appareil extenseur*) attached to the base of the penis, which form such a striking feature of Tabanidae (Text-fig. 26, *fl.*).

With regard to speciation, the genitalia offer considerable assistance in some cases but in others none at all. In the *personatus* group they are of the greatest value in separating many species, and also help in determining their mutual relationships, while in the *fulvus* group the genitalia differ even more than do the three species in body form, colouration and markings. Good differences are also found between the series of the *fusconiger* group, including the Chilean species, but within the series the differences are frequently slight and unreliable. It is significant that it is in the *fusconiger* series that the discrimination of species on other characters is most difficult.

B. THE LARVA.

The eggs are unknown. As all the known larvae are closely similar, that of *P. fulvus* Ric. has been selected for detailed description. Notes on the difference between the species will be given later (pp. 69-71).

General description.

The full-grown larva is elongate and worm-like (Text-fig. 29), though hard and rigid. Its general form is cylindrical, pointed at each end, but more sharply anteriorly. It has a strong, glassy sheen, and is hard, slippery, and waxy to the touch. The integument is very thick, but the tracheae and other organs are distinguishable through the skin in many larvae. There are no striations, projections, or papillae of any kind, the surface of the body being perfectly smooth and sleek. The colour varies through shining translucent white (the commonest), to cream and pale lemon or apricot shades.

The resistance of the skin may be judged by the fact that it is difficult to tear or macerate even after prolonged boiling in caustic potash. Larvae prepared without boiling in potash, but cleared in alcohol and oil for examination of the skin glands showed the three layers of the integument to be well defined, the inner being typically thin and membranous and staining readily, the middle thick and fairly elastic, and the outer cuticle remarkably thick and rigid. Prolonged soaking in osmic acid stained the cuticle, but the other layers remained colourless.



Text-figs. 29-31.—29. Living larva of *P. fulvus* Ric. 30. Pupa of *P. fusconiger* Walk. 31. Larva of *Chrysopilus aequalis* Walk. (Rhagionidae).

The head (Text-fig. 33) is elongate, narrow, and not capable of much protrusion from the first thoracic segment, from which a membranous extension envelops it to the base of the mouthparts. Only the anterior extremity carrying the mouthparts appears when it is extended (Text-fig. 32), and when withdrawn only the tips of the mandibles and maxillae are visible. The first thoracic segment is small, and the second and third progressively larger. The eight abdominal segments are longer than wide, the posterior ones more so than the first two. The junction between the segments is marked as a thin brown line, and the body is very slightly constricted between each segment, but is incapable of contracting or telescoping. All the abdominal segments except the last are similar.

The second to the seventh abdominal segments bear laterally a small transverse series of from five to eight small flat scale-like structures. They are gland openings, circular areas slightly more coloured than the surrounding integument and with a minute pore in the centre. They occur just behind the anterior margin of each segment and are difficult to discern in the second and third segments, but conspicuous in the others. In section it is seen that these glands are squat bottle-shaped with a long neck. At the base of the cuticle the duct narrows suddenly and takes a sharp bend, passing through it to open on the surface. It is considered that these are probably the ecdysis glands, the openings being more than usually noticeable in *Pelecorhynchus* because of the smooth surface and lack of folds or papillae which usually conceal them in other larvae.

On the eighth abdominal segment there are four longitudinal rows of similar dots, but these are larger and paler than the gland openings (Text-fig. 69). They are arranged on each side in one short row of about eight to ten dots dorso-laterally, and another of about five to seven ventro-laterally. They are not connected with any gland, have no central pit, and vary in number. They probably represent the dorso-lateral and ventro-lateral grooves or lines, which in Tabanidae are represented by rugose areas in this region.

The smallest larva available for examination was 13 mm. long, and the full-grown larva measured 50 to 52 mm. The structure of the various instars is the same, but the younger larvae are thread-like or wire-like and more transparent in appearance, whereas the larger larvae are relatively thick and robust. Some of the younger larvae attain almost the length of the full-grown ones, but are distinguished by being much narrower. The only difference detectable in the earlier instars is in the spiracles, which are lighter

and have only two openings in the anterior pair, and fewer openings around the posterior pair.

Chaetotaxy.

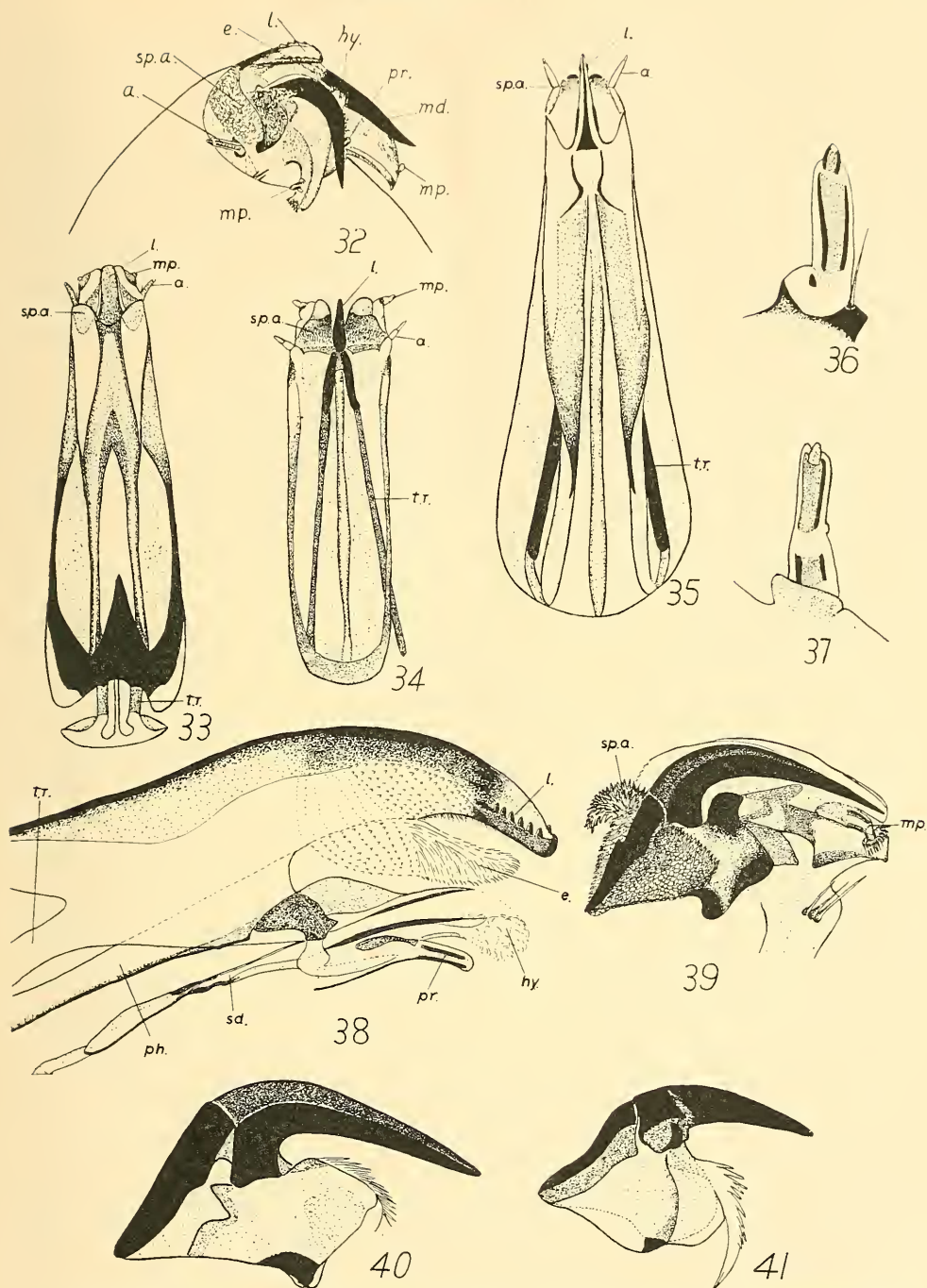
The thoracic hairs are very minute and colourless, and are hidden in small depressions, only being detectable with oblique lighting and high magnification. They are so extremely minute that they are intangible, having no effect on the general smoothness of the larva. There is a pair of depressions ventrally on each thoracic segment, and from each of these arise three or four fine hairs, all the same length. As well as these ventral hairs, which are present in one form or another in all dipterous larvae but are here remarkably reduced, there are other single hairs on the thorax and last abdominal segment. On the first thoracic segment there is a ventral row of six just behind the head, and two dorso-lateral groups of three or four hairs. Also in a line with the pair of ventral groups are two lateral and two dorso-lateral groups with three or four hairs in each. On the eighth abdominal segment the arrangement of the small hairs is as follows.—There is one hair at the posterior end of the dorso-lateral row of dots, none at the ends of the ventro-lateral dots, one laterally between the dorsal and ventral rows, and a pair ventrally between the ventro-lateral rows. All these hairs are more or less in a circle around the segment. Ventrally there are two more hairs situated posterior to the other ventral pair and nearer the mid-line. Just anterior to the spiracular cavern are the two dorso-lateral and the two ventro-lateral hairs, and on the lower lip of the cavern near its margin are six hairs.

The Head and Mouthparts.

The strongly chitinized epicranium (Text-fig. 33) is strengthened by longitudinal bands of thicker chitin, and, with the lateralia and ventral plate, it forms a sheath in its anterior third around the bases of the mouthparts. Ventrally, the open posterior two-thirds is occupied by the tentorial rods, lying close together and running the full length of the head, and by the pharynx, running between the rods in the first half and above them in the posterior half. The tentorial rods are articulated at the anterior end with the mandibles and maxillae, and in the anterior fourth are connected with the epicranium, making a narrow channel through which the pharynx passes. At the posterior end the rods project past the epicranium and are connected by an arch of light, colourless chitin.

Latero-ventrally in the anterior fourth are the eye-spots lying beneath the lateralia. Each is a thick oval mass of reddish-brown pigment. The antennae (Text-fig. 36) are large and conspicuous, consisting of an elongate, cylindrical, basal segment, with a small, dome-shaped one at the apex. Dorsally, between their bases and the base of the labrum, and attached to the maxilla, is an area of bristles pointing upwards (Text-fig. 33, *sp. a.*). They lie beneath the lateralia in a pocket when the mouthparts are contracted, and when protruded they are free to project up and backwards. They correspond in position and structure to the spinose area in *Tabanidae* and *Rhagionidae*, which Bischoff (1924) describes as the *cardo* of the maxilla. There is a fine spine at the base of the antenna on the lower side. Ventrally, between the narrow labium and the edges of the lateralia, is a membranous area on each side, bearing three closely associated bristles.

The epicranium ends anteriorly in a median dorsal rostrum, forming the strong, chitinous labrum, which is strongly curved ventrally, the tip being blunt, with a row of short, strong teeth on each side, just behind the tip (Text-fig. 38). Although it is broad on the dorsal surface, the labrum becomes laterally compressed beneath in the epipharyngeal region, where it is extremely hirsute, the epipharynx being a tongue-like projection covered with sensillae and hairs. The labium is complex, consisting of the hypopharynx which lies close against the epipharynx, and the prementum. The hypopharynx has a fine, delicate apex, is membranous, with a comb of very light and transparent cilia, and is supported by chitinous rods running from the base. At its base there is a heavy chitinous mass connecting it with the floor of the pharynx, and there is a strong piece where it forms the floor of the buccal cavity. The salivary duct opens at the apex of the hypopharynx and lies beneath the pharynx. It possesses a valve or pump-like section, and from here to the external opening the duct is more strongly



Text-fig. 32.—Mouthparts of larva of *P. rubidus*, n. sp. a, antenna; sp. a., spinose area; e., epipharynx; l., labrum; hy., hypopharynx; pr., prementum; md., mandible; mp., maxillary palp.

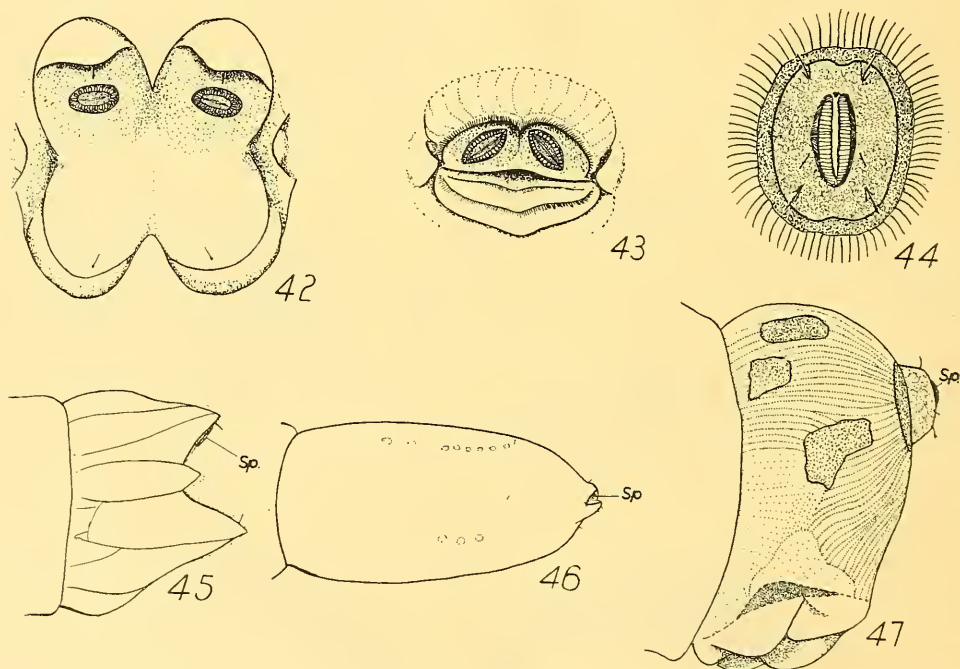
Text-figs. 33-41.—33. Head of larva of *P. fulvus* Ric., tr., tentorial rod. 34. Head of larva of *Chrysopilus aequalis* Walk. (Rhagionidae). 35. Head of larva of *Tabanus froggatti* Ric. (Tabanidae). 36. Antenna of larva of *P. fulvus* Ric. 37. Antenna of larva of *Chrysopilus aequalis* Walk. 38. Lateral view of labrum and labium of larva of *P. fulvus* Ric., ph., pharynx; s.d., salivary duct. 39. Maxilla of *P. fulvus* Ric. 40. Mandible of *P. fulvus* Ric. 41. Mandible of *Chrysopilus aequalis* Walk.

chitinized than elsewhere. Beneath the hypopharynx is the prementum, a rather small palp-like median structure connected with the base of the hypopharynx (Text-fig. 38).

The mandibles are slender, sharply pointed and strongly chitinous (Text-fig. 40). They lie close against the labrum, taking the same curve, and when the mouthparts are retracted are difficult to detect, as they are hidden between the maxilla and labrum. They are expanded at the base and connected with the maxilla, working in conjunction with them. The maxilla (Text-fig. 39) has a chitinous point, which is shorter, blunter and wider than that of the mandible, and lies below and slightly in front of it. Above it and slightly anterior, is a small tuft of small strong spines, whilst laterally are the palps, short and pointing outward. At the base of the maxilla, lying inside the lateralia, is the spinose area or cardo. It comes away connected with the maxilla when this is dissected, and remains in a position corresponding to the banded segment of Stratiomyidae. The strong, chitinous masses at the bases of the mandible and maxilla are connected, and articulate with the tentorial rods.

The spiracles.

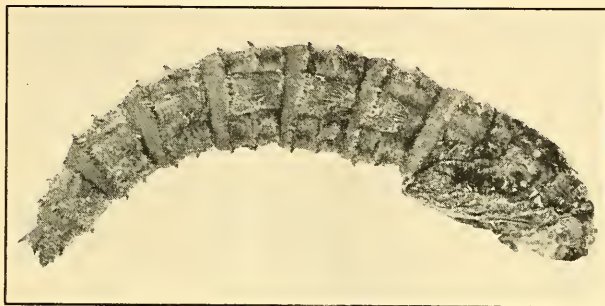
The larva is amphipneustic, and no trace of the lateral spiracles has been retained. The anterior spiracles are very small, and open laterally on the first thoracic segment a little before the posterior border. They are light yellowish in colour, and consist of a small plate with three oval slits placed close together. A few larvae are found with four or even five slits.



Text-figs. 42-47.--Last abdominal segment and spiracles of larvae. 42. *Chrysopilus aequalis* Walk., end view. 43. *P. fulvus* Ric., end view. 44. *Tabanus froggatti* Ric., end view. 45. *Chrysopilus aequalis* Walk., lateral view. 46. *P. fusconiger* Walk., lateral view. 47. *Tabanus froggatti* Ric., lateral view. *sp.*, spiracle.

At the extreme apex of the last segment there is a transverse slit guarded by a pair of lips, which bear a fringe of fine hairs on their inner edges, and which open into a shallow fissure or cavern (Text-fig. 43). The upper or dorsal lip is short and the lower or ventral more protruding. The lower lip may be dropped down, leaving the spiracles well exposed, and when the cavern is stretched wide open, the spiracles appear on a vertical face, and the cavern itself becomes merely a shallow depression. When the lower lip is brought up, closing the fissure, only a thin, curved slit is visible, and the spiracles

then lie on the roof of the cavern and face downwards. The upper lip is slightly notched in the centre, giving the appearance of being a pair of fused short, wide papillae. The lower lip is entire, and has a groove at its base where it is hinged. Laterally, where the lips meet at the corners, there are two small lobes. The spiracles are light brownish and lightly chitinized. There is a pair of plates, elliptical oval in shape, sloping away from each other towards the base, or pointing outwards at the bottom. Each spiracle has a narrow slit running longitudinally through the centre, cutting the plate into two sides. These have the typical scalloped margin, being divided into sixteen or seventeen little divisions by chitinous bars. Each spiracle has a separate felt chamber joining it to the tracheal trunk. At the base of the spiracles, and at the bottom of the cavern is a row of six little gland openings.



Text-fig. 48.—Pupa of *P. fulvus* Ric.

C. THE PUPA.

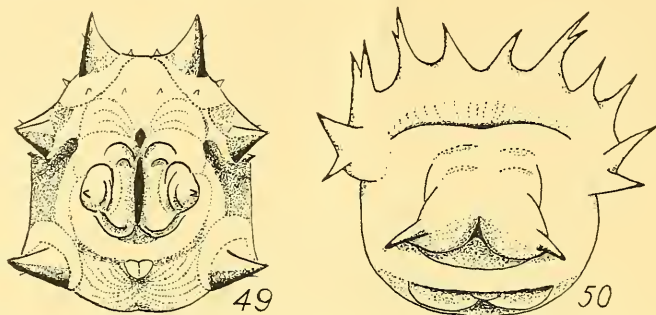
The pupa (Text-fig. 48) is large, of typical Tabanoid form, with a comparatively short thorax, the wings and legs not extending beyond the first abdominal segment. It is slightly curved towards the ventral surface, and has a thick, dark brown, chitinous integument, leaving a tough, resistant shell after emergence of the fly.

The chitin of the head and thorax is very wrinkled and corrugated. The antennal sheaths are widest at the base, and are short and broad throughout their length as in Tabanidae. They are directed obliquely outwards and downwards. There is an arrangement of bristles on the head and thorax as follows: a pair on the vertex, a pair behind the vertex, a pair on the face, two pairs below the antennae; a series of six smaller ones dorsally between the spiracles, two pairs medially on the dorsum of the thorax close to the suture line, one at the base of the first leg, and one on the metathorax laterally. All the bristles are fine and light brown. On the vertex and at the back of the head, the surface is broken into little mounds and swellings. The thoracic spiracle is large and raised on a mound. The slit is transversely placed at the apex of the mound, and is straight, but hooked at each end.

The abdominal segments are divided into dorsal, ventral and lateral areas by grooves, the lateral areas forming a rounded ridge right down the side of the abdomen. On these the spiracles occur, the slit being at the apex of a mound, scroll-shaped with the opening anterior. At one-fourth the length of the segment from the posterior edge, each segment has a girdle of spines which are clearly seen in the illustrations. The integument in front of the spines is wrinkled transversely, whilst that behind them is finely rugose. The spines are strong, broad, sharply pointed, and closely set. They vary in size, long and short being intermingled without order. Some have two or three subsidiary spinelets below their apices. In addition, just anterior to the middle of the segment are four blunter, heavy spines dorsally, and two ventrally. The first abdominal segment has no spines but there are four minute projections dorsally.

The eighth abdominal segment is short (Text-fig. 49), and encircling it centrally is a girdle of six large spines, bigger than any on the other segments, and bearing a distinct superficial resemblance to the aster of Tabanidae. There are two dorsal, two dorso-lateral and two ventro-lateral spines projecting outwards and backwards. Some have

tiny accessory spines at their bases. Apical in position and directed posteriorly is a large ventral swelling bearing the true aster. This consists of a pair of lateral projections, which are short and wide and drawn into a papilla at the end, and two pairs of flat, scarcely raised knobs, one above and one below the larger projections. Anterior to the aster ventrally is the anal knob.



Text-figs. 49-50.—End view of last segment of pupae. 49. *P. fulvus* Ric. 50. *Chrysopilus aequalis* Walk. (Rhagionidae).

The pupa of the male is smaller than that of the female, with a more slender abdomen. The end segment is slightly different. The terminal projections are smaller and narrower, the anus is larger, and anterior to it is another swelling with a pair of blunt papillae. This lies in line with the six points of the girdle, in a ventral position. On emergence of the adult, the thorax splits longitudinally down the centre of the back, and the whole of the head and face shield falls off.

3. RELATIONSHIPS AND PHYLOGENY.

In this Section, two questions have to be discussed:

1. Is the group homogeneous, and in particular are the South American species congeneric with those from Australia?
2. What is the position of the group in the Tabanoidea?

A. THE HOMOGENEITY OF THE GROUP.

The treatment of the morphology in the previous Section was based on a review of all the species available to us. It remains here to list those characters which are common to the species, to note the exceptions, to discuss in more detail those which can be relied on to indicate relationships, and also to discuss the various differences, real and alleged, which have been used to separate *Coenura* from *Pelecorhynchus*.

The characters in common are briefly as follows:

1. Habitus. All, with the exception of a few Australian species, are large, robust, ornate flies with a very characteristic appearance.
2. Form of head, structure of eyes, presence of ocelli, the wide frons of the female, protuberant face of both sexes, structure of antennae and form of proboscis. In *P. longicaudus* Bigot, the proboscis is very short, but is similar in form to the other species.
3. Reduction of the mandibles of the female. The reduction is greater in *P. longicaudus* Bigot than in the other species we have examined.
4. Structure of the palpi. *P. flavipennis* Ferg. and *P. longicaudus* Bigot are exceptions and a few species have palpi intermediate between the normal form and that found in *P. flavipennis* Ferg.
5. The conformation of the pleural sclerites.
6. The arrangements of the tufts of pubescence. Special mention may be made of the infrascutellar tuft, the post-mesopleural tuft and the hypopleural tuft.
7. The venation of the wing and the vestigial squamae.
8. The presence of spurs on the mid and hind tibiae.
9. The form of the terminal segments of the female, particularly the cerci.

10. The structure of the male genitalia. There are many differences in detail, but all are built on the same basic plan. Even the recurved hooks of the aedeagus characteristic of the Chilean species also occur in the Australian *P. rubidus*, nov.
11. The structure of the early stages. The known larvae and pupae are all extremely similar, differing only in minor points of colouration and configuration of the last abdominal segment.

Some of these characters, such as the subulate antennae, the small squames, and the venation of the wing, are indications of a primitive condition, and are found individually though not collectively in other genera of the Tabanoidea; others, like the reduction of the mandibles, are adaptive and are consequently to be treated with caution; but there are still others, notably the structure of the male and female genitalia, which definitely indicate genetic relationship. It is inconceivable that a type possessing all these characters could have evolved twice over—the group is clearly monophyletic and closely knit.

The facts recorded above may be regarded as the positive evidence of homogeneity. We must now consider the differences real and apparent which have been recorded. When one examines the species, it is found that they fall naturally into three congeries of related species, described in the systematic revision below (p. 43), as the *personatus* group, the *fulvus* group, and the *fusciger* group. The last includes several Australian and all the Chilean species, and may be further subdivided into several subgroups or series. It is to be emphasized that these groups and series are based chiefly on colouration and markings of the adults, and that there is no significant structural difference between them. Moreover, there is no significant difference between the known larvae and pupae of the three groups. That this arrangement of the species into groups and series is a natural one is very clear when one has the specimens before one. We hope that the descriptions and figures in the systematic revision will prove adequate to give the reader who has not the material a sufficiently clear idea of their relationships.

Before dealing with the work of Bigot (1857) and Enderlein (1925), it is desirable to discuss *P. longicaudus* Bigot, which is the type of the genus *Coenura*. This species is similar in basic pattern and especially in male genitalia to the other Chilean species, with the exception of *P. vulpes* Macq., and forms with them a natural subgroup. It is, however, peculiar in the following respects:

1. The ruff and pleural hairs, though normal in position, are less dense than in most species, though not less than in some Australian species, such as *P. tillyardi* Tayl. and *P. fascipennis*, nov.
2. The proboscis, though of normal form, is decidedly shorter than in any of the other species.
3. The mandibles are more reduced than in any other species we have examined.
4. The form of the palpi is unusual, and is only closely approached by the Australian *P. flavipennis* Ferg.

None of these characters is, in our opinion, reliable for generic separation. Moreover, if used for this purpose, they would only serve to separate *P. longicaudus* Bigot from the other Chilean species, and place it by itself, or with certain of the Australian species to which it is not so closely related. The structure of the palpi is a case particularly in point. If this is used, *P. flavipennis* Ferg. would have to be placed in *Coenura* and one would be faced with the difficulty of classifying those species which possess palpi intermediate between this and the typical form. Incidentally, attention may be called to the great differences in the form of the palpi described by Ferguson (1926) in the genus *Scaptia*, which is very homogeneous in nearly every other respect. Such a subdivision would be typical of an artificial as opposed to a natural classification.

So far as the characters used by other authors are concerned, Bigot did not compare *Coenura* with *Pelecorhynchus*, but stated that the antennae were composed of eleven segments and that the proboscis was hidden in repose. Neither of these statements is correct, and the other characters mentioned by him, with the exception of the palpi, are

common to all the species of *Pelecorhynchus*. Enderlein distinguished the two genera as follows:

1. Endglied des Palpus fadenförmig. Augen des ♂ in 2 scharflinig geschiedene Teile geschieden, der obere mit grossen, der unten mit kleinen Ommatidien (australisch) *Pelecorhynchus*
- Endglied des Palpus diskusförmig. Augen des ♂ normal (chilenisch) *Coenura*

The structure of the palpi has been dealt with above and the alleged differences in the eyes, as Ferguson (1926) has pointed out, do not exist, the facets being subequal throughout in the males of all species. The other characters listed by Enderlein in his definitions, including the form of the ovipositor, are equally unsatisfactory.

It has thus been shown that the genus *Coenura* Bigot cannot stand as at present constituted. Can the group be divided logically into genera or subgenera in other ways? In our opinion it cannot. In making genera, two considerations should be clearly before one—firstly, that the genera proposed should give a clear indication of the relationships of the species, and secondly, that, so far as is compatible with the first consideration, the genera should be of a convenient size. The multiplication of genera, often on trivial grounds, has gone on to such an extent that the student of phylogeny, and particularly of zoogeography, cannot marshal his evidence, unless he is a specialist on the groups with which he is dealing. The group here under consideration is a compact assemblage of a convenient number of closely related species. As a single genus it is a unit intelligible to the general zoologist and we therefore treat it as a unit.

As far as subgeneric subdivision is concerned, the three groups within the genus might be given subgeneric status, in which case the name *Pelecorhynchus* would be confined in a subgeneric sense to the *personatus* group, and *Coenura* would be applicable to the *fusciger* group, the *fulvus* group requiring a new name. Subgenera are useful when the genus is a large one, as for example in the genus *Aedes* of the Culicidae, but the nomenclature is cumbersome, and there should be good morphological grounds for introducing them. In the genus *Pelecorhynchus* these grounds are not in our opinion adequate, the groups, though natural, being based simply on colouration and markings. The mutual relationships of the species are sufficiently indicated by the use of "groups" and "series" and there appears to be no reason for the introduction of additional names.

B. POSITION IN THE TABANOIDEA.

The Brachycera Homoiodyctyla have been subdivided in various ways by different authors. Thus, Tillyard (1926) treats the whole group as a single superfamily, the Tabanoidea, whereas most others recognize three or four superfamilies. A typical and fairly conservative example is that set out in tabular form by Malloch (1917), of which the relevant portion is:

STRATIOMYIOIDEA.	TABANOIDEA.
Stratiomyiidae	Tabanidae
Xylophagidae	Leptidae
Coenomyiidae	CYRTOIDEA.
Acanthomeridae	Cyrtidae
	Nemestrinidae

The Bombyliidae, although lacking pulvilliform empodia, have also been included here (e.g., by Ségny, 1926).

For the purposes of this discussion, the Cyrtidae and Bombyliidae may be excluded, as showing no close affinity with *Pelecorhynchus* in significant structural characters either of the adults or of the early stages. The Nemestrinidae do show Tabanoid affinities in the structure of the ovipositor and in some other respects, but they diverged from the main stem so widely, and presumably so early, that they also may be excluded. We are left with three main families, Stratiomyiidae, Rhagionidae (= Leptidae), and Tabanidae, together with a group of smaller families of somewhat debatable position. Generally these have been placed between the Rhagionidae and Stratiomyiidae, and with this we agree, being quite unable to follow Brues and Melander (1932) in placing the Xylophagidae (s.s.) and Coenomyiidae with the Rhagionid-Tabanid complex, or Thorpe (1934) in assigning a similar position to the Pantophthalmidae.

In spite of divergence in form and detail, which justify recognition even of the smaller annectant families, the whole group (Stratiomyoidea + Tabanoidea of Malloch) forms a continuous, unbroken series clearly separated from other Brachycera, and we propose to treat it as a single superfamily, the Tabanoidea, within which three main lines of evolution are represented (p. 31). The Rhagionidae may be taken as central. On the one side lies the Stratiomyiidae, linked with the Rhagionidae through the Chiromyzinae, Xylomyiidae, Coenomyiidae, and Xylophagidae (s.s.). On the other side lies the Tabanidae. In the past, the genus *Pelecorhynchus* has always been recognized as a Tabanid, although Enderlein (1925) appreciated its primitive position, and placed it (with *Coenura*) as a separate subfamily at the base of the Tabanid stem. With this general picture in mind, we may re-examine the position of *Pelecorhynchus* in the light of the morphological evidence set out in the previous Section.

The Adult.

In size, general habitus, ornamentation, and many external characters, the species of *Pelecorhynchus* resemble Tabanidae, and stand widely apart from all other families of the group. Nobody seeing them alive, or examining them in a store-box, would take them for anything but Tabanidae, and it is not surprising that earlier authors placed them as they did. The form of the head, however, is more generalized than in most Tabanidae, but, apart from its pubescence, it gives no indications of particular relationships. Similarly, the antennae, with their subulate, 8-annulate third segment, are simply primitive, the same type occurring in Xylomyiidae, Coenomyiidae, Xylophagidae, and some Tabanidae. They do, however, set *Pelecorhynchus* apart even from primitive Stratiomyiidae and from true Rhagionidae, all of which have a more specialized antennal plan, with reduction in the number of annulations.

The proboscis, the unusual form of which was noted by Macquart as long ago as 1850, is intermediate in development between the strong, relatively rigid type of the blood-sucking Tabanidae and the short, thick, soft, retractile type of other families. A gradation is seen within the genus itself, some Australian species, such as *P. fusconiger* Walk. (Text-fig. 1) approaching the Tabanidae, whereas the Chilean *P. longicaudus* Bigot is quite similar to normal Rhagionidae.

The other mouthparts show the same interesting gradation. Well-developed mandibles occur only in the females of Tabanidae and of the blood-sucking Rhagionid genus, *Spaniopsis*. All other Tabanoidea known to us lack them, or at most have vestigial spikes. Nevertheless, they must have been present in the ancestral Tabanoids, for it is inconceivable that such organs should re-develop when once they had been lost. *Pelecorhynchus* shows the stages in their reduction. *Scaptia patula* Walk. (Text-fig. 6) may be taken as representing the fully-developed condition seen in Tabanidae, and this species is of particular interest, as it is not a blood-sucker but exclusively a flower feeder like *Pelecorhynchus*. The female of *P. distinctus* Tayl. (Text-fig. 5) represents an early stage in reduction, for, while the mandibles are still fairly long, they are definitely more tenuous than in *S. patula* Walk., and a more advanced stage is shown by *P. longicaudus* Bigot (Text-fig. 4), which has the mandibles reduced to relatively short spikes. Similar, but shorter and less constant mandibular spikes have been noted in Nemestrinidae (Mackerras, 1925). *P. longicaudus* Bigot leads naturally to the Rhagionidae (Text-fig. 3), in which the mandibles have completely disappeared and the maxillae are showing indications of reduction. The final stage in reduction is seen in some Stratiomyiidae, such as *Chiromyza*, which have an extremely short, broad, soft proboscis, with large labellae, no trace of mandibles, maxillae which are little more than strong chaetae, and the labrum and hypopharynx reduced to triangular lobes.

The form of the palpi is Tabanid rather than Rhagionid, most of the Australian species having the palpi of both sexes similar to those of the males of *Scaptia* and *Palimmeconyia*. It is curious that *P. longicaudus* Bigot, which approaches Rhagionidae in other respects, has the most Tabanid-like palpi in the genus.

There is little of note in the thorax or its appendages. The marked development of dense, silky pubescence would associate *Pelecorhynchus* with the Pangoniinae rather than the Rhagionidae, but Nemestrinidae and many Bombyliidae are just as hairy, and

it is doubtful if the character has any phylogenetic significance. The tibial armature may also suggest Pangoniine affinities. The wing venation is neither Rhagionid nor Tabanid, but rather that of the annectant families leading to the Stratiomyiidae. It is, in fact, a basic type, from which any of the others could have developed, but perhaps showing a hint of Tabanid relationships in the relatively short cell M_4 . On the other hand, the almost complete absence of squames distinguishes *Pelecorhynchus* sharply from the true Tabanidae, and allies it with the other more primitive groups, or with the Rhagionidae.

The form of the abdomen is intermediate between the primitive, conical type of the Chiromyzinae, Coenomyiidae, and some Rhagionidae, and the dorso-ventrally compressed Tabanid type, with its sharp distinction between the bulky first four segments and telescoped remainder. In form it tends to resemble the latter, but its extensibility links it with the former. The ovipositor of the female is, however, much more primitive than that of any Tabanid, the possession of two-segmented cerci being shared, in the groups we have examined, only by *Pelecorhynchus*, Rhagionidae, Coenomyiidae, and Chiromyzinae (see Text-figs. 11-17). Another highly significant character of the female is the shovel-shaped eighth sternite, with its cleft distal end, which, from its resemblance to the corresponding sternite of *Chorista*, we believe to represent the most primitive condition found in the Diptera. Finally, the genitalia of the male, especially the trilobed style and the complex aedeagus, are quite unlike the Stratiomyiid, Rhagionid, or Tabanid types. They probably represent a more primitive condition, which has persisted in this group, and which effectively prevents us from associating it definitely with any of the existing families.

In short, the adult *Pelecorhynchus* shows affinities with both Tabanidae and Rhagionidae, shares many primitive features with Coenomyiidae and its allies, and possesses characters of its own which set it apart from all the families.

The Larva.

The larvae of *Pelecorhynchus* are far removed from the Stratiomyiid type. They differ from the Stratiomyiidae (as represented, for example, by the primitive Chiromyzine genus *Boreoides*) and from Xylomyiidae not only in the elongate, cylindrical body form, and absence of bristles and calcareous plates, but also in having a retractile head, differentiated mandibles and maxillae, and no pharyngeal pump. The only point of resemblance lies in the similar general structure of the hypopharynx and prementum. The respiratory systems of *Pelecorhynchus* and Stratiomyiid larvae are also widely different, the latter being peripneustic and with the posterior spiracles lying in an internal air chamber. These distinctions hold true both for terrestrial and aquatic Stratiomyiidae. The larvae of Pantophthalmidae are thickened and Stratiomyiid-like, with external characters resembling those of Xylophagidae, but, from Thorpe's (1934) description and figures, they appear to be more closely related on mouthparts to the true Stratiomyiidae. They certainly bear no relation to *Pelecorhynchus*.

The remaining annectant families, Coenomyiidae and Xylophagidae, have larvae bearing bristles, pseudopods, terminal processes, and chitinous plates, none of these structures being represented in *Pelecorhynchus*. Moreover, the head is non-retractile. On certain structures of the mouthparts, however, they are closer to Rhagionidae and *Pelecorhynchus* than are the Stratiomyiidae and Xylomyiidae. The hypopharynx and prementum are of the same general type for all these families, but the structure and relationships to one another, of the mandibles and maxillae are similar in *Coenomyia* and *Xylophagus* to *Pelecorhynchus* and *Chrysopilus* (see Bischoff, 1924, fig. 13). On the other hand, the posterior spiracles in Coenomyiidae and Xylophagidae lie exposed on the dorsal surface anterior to the chitinous plate, differing greatly from those of *Pelecorhynchus*.

Pelecorhynchus has many features in common with *Chrysopilus* and *Rhagio* in the family Rhagionidae. The general form of the body is somewhat similar, being elongate, slender, smooth, cylindrical, and white, as distinct from the Stratiomyiid type (cf. Text-figs. 29 and 31). The heads are of similar structure, are equally retractile, and the mouthparts show a striking similarity (Text-figs. 33-41).

Pelecorhynchus and *Chrysopilus aequalis* Walk. have the same kind of mouth opening and buccal cavity, the labrum and labium are of the same form and relation to each other, a prementum of the same type is present in both, and the mandibles and maxillae are of the same structure and bear similar relations to each other, even the spinose area at the base, or "cardo", being the same. In *Rhagio lincola* Fabr. and other species described by Bischoff, the mouthparts are similar to those of *Chrysopilus*.

Other features which these genera have in common are found in the respiratory apparatus and the structure of the last abdominal segment. The anterior spiracles are external, visible, and of the same form. The posterior spiracles are in a fissure or cavern at the posterior extremity of the body, the upper lip or roof of which bears the two stigmatic plates (Text-figs. 45, 46). These are of the same shape, structure, and relative position in each. Both upper and lower lips of the spiracular cavern have two lobes in *Chrysopilus* (Text-fig. 42), whilst in *Pelecorhynchus* an indication of lobing is seen in the upper lip only (Text-fig. 43), but *Ptiolina* (Lundbeck, 1907, p. 155) appears to have a spiracular cavern with similar lips to *Pelecorhynchus*. The placing of the spiracles in a horizontal fissure at the extreme end of the body is a feature *Pelecorhynchus* shares with all Rhagionidae, with the exception of the aquatic *Atherix*, which has gills. The position and structure of the anus on the eighth abdominal segment are the same.

Pelecorhynchus has no well-marked relationships with the Tabanidae, differing from all known Tabanids in being rigid and incapable of contraction, and in the absence of pseudopods, striations, and rugose plates. Also the mouthparts of *Tabanus* are highly specialized and have no oral aperture, the food being taken in through the mandibular pore. Tabanids, moreover, lack the prementum of *Pelecorhynchus*, and possess a large, complex salivary pump. The general structure of the mandibles and maxillae is, however, similar to that of *Pelecorhynchus* and Rhagionidae. Graber's organ, which is so characteristic of Tabanidae, is entirely absent in *Pelecorhynchus*, and the position and structure of the anus are quite different. The respiratory system in the two groups is decidedly different, the anterior spiracles being non-functional in Tabanidae, and the posterior spiracles united in a single vertical fissure, which is situated at the end of a more or less elongate siphon (Text-figs. 44, 47).

Thus, on its larval characters alone, *Pelecorhynchus* would be classified without hesitation as a Rhagionid, and the question of its relationship with the Tabanidae or the Stratiomyioid families would hardly arise.

The Pupa.

As the Stratiomyiidae have no free pupa, they can hardly be included in this discussion. Even the primitive Chironomyzine, *Boreoides*, remains within the puparium until emergence, but dissection just before this occurs, shows the nymph to be typically Stratiomyiid. *Xylomyia* has a delicate pupal skin, which is left projecting from the puparium after emergence of the fly; but its structure is similar to the *Boreoides* nymph, and it bears no resemblance to the *Pelecorhynchus* pupa. From the descriptions available, it is assumed that the Pantophthalmidae also have no free pupa, but this point is uncertain. All the remaining families have pupae of a similar general type. Those of Xylophagidae and Coenomyiidae, however, are easily distinguished from *Pelecorhynchus*, in that the antennae are elevated and project laterally on top of the head, the abdominal girdles consist of long bristles, with smaller spines between, and the armature of the last segment is different. The pupa of *Coenomyia* is about the same size as that of *Pelecorhynchus*, whilst that of *Xylophagus* is only about half as big.

While the pupae of Rhagionidae can always, and those of Tabanidae usually, be distinguished from *Pelecorhynchus* by size alone, there are many interesting structural resemblances and differences between the three groups.

The form of the antennal sheaths shows differences corresponding to the differences in the antennae of the adults, but the differences in their disposition are more illuminating. In the Rhagionidae they point almost directly downwards, in *Pelecorhynchus* they point obliquely laterally and downwards, whilst in Tabanidae, including *Scaptia*, they are directed laterally.

Tabanidae possess a peculiar and characteristic feature, which is not shown either by *Pelecorhynchus* or Rhagionidae, namely, the small medial pore, opening into a deep aperture connected with the thoracic spiracle. The form of the spiracle is similar in *Pelecorhynchus* and Rhagionidae, the slit being straight with hooked ends; but, whereas it runs transversely in *Pelecorhynchus*, it is directed diagonally in *Chrysopilus aequalis* Walk. and other Rhagionidae. In typical Tabanidae the slit is curved and ear-shaped, and runs longitudinally. The more primitive *Scaptia auriflua* Don., however, is intermediate, in that the slit, though still ear-shaped, is shorter than usual and inclines more in the direction of *Chrysopilus* (Fuller, 1936). The spiracles lie flat on the surface in most Tabanidae, but are slightly raised in *Scaptia*, more so in *Pelecorhynchus*, and even more elevated in Rhagionidae.

The girdle of spines on each of the first seven abdominal segments is unmodified in the three groups, but *Pelecorhynchus* possesses additional spines, which take the form of two dorsal pairs and sometimes a ventral pair anterior to the girdle. These have not been found in Tabanidae nor in most Rhagionidae, although Lundbeck (1907) mentions a dorsal pair as a generic character of *Rhagio*.

The armature of the last abdominal segment shows interesting homologies. *Chrysopilus aequalis* Walk. may be taken as representing the most primitive condition (Text-fig. 50). In this species there is a girdle of spines similar to the girdle on the other abdominal segments. At the apex of the abdomen posterior to the girdle, is a pair of strong lateral processes, which are homologous with the lateral arms of the aster in the Tabanidae. Other species of *Chrysopilus* have the primitive bilobed aster, but show considerable modifications in the girdle. Thus, *C. ornatus* Say., described and figured by Malloch (1917), has the girdle reduced to six large spines which much resemble a Tabanid aster, while *C. quadratus* Say., besides possessing the six large aster-like spines, has smaller ones between them, representing the remainder of the girdle. On the other hand, the primitive Tabanid, *Scaptia auriflua* Don., has an unmodified girdle, but shows a very interesting development of the aster in the appearance of a pair of minute lobes above and below the large lateral arms (Fuller, 1936, fig. 11). These undoubtedly represent the dorsal and ventral arms of the typical aster of Tabanidae.

Again *Pelecorhynchus* is intermediate. The girdle resembles that of *Chrysopilus ornatus* Say. in having six large aster-like spines, and the resemblance goes even further, for some species have the small accessory spines of *C. quadratus* Say., while others have not. The aster resembles that of *Scaptia*, with the rudimentary dorsal and ventral arms better developed in some species than in others.

Of the remaining groups, Coenomyiidae and Xylophagidae have the primitive bilobed aster of the Rhagionidae, but show a different specialization of the girdle, which is modified to form four fan-like groups of spines. Typical Tabanidae, on the other hand, have a fully-developed aster, and they also show a special modification of the girdle, which is represented by two or four groups of spines, termed the dorso-lateral and lateral combs, and a row of ventral spines, which in females is divided into two series by a median gap, the six groups of spines in this sex corresponding with the aster-like arms of *Pelecorhynchus*.

The pupa, then, like the adult, is intermediate between the Rhagionidae and the more primitive Tabanidae, but unlike the adult, it does not show so many points of resemblance to *Coenomyia* and its allies.

Discussion.

A study of such a primitive type as *Pelecorhynchus* would be incomplete without some attempt to reconstruct the evolutionary history of the larger group to which it belongs. In the first place, we feel justified in regarding the Tabanoidea (including the Stratiomyioidea of Malloch) as monophyletic. There are too many points of similarity between the more primitive members of all the included families to permit of any other conclusion, in spite of the wide divergence of the more specialized Tabanidae and Stratiomyiidae. The common ancestral type, from which they all developed, was probably not far removed from the existing Coenomyiidae and Pelecorhynchidae, and may be visualized somewhat as follows:

The adult was a medium-sized insect, with a moderately large head, ocelli, ten-segmented, subulate antennae, and a short, stout proboscis. The female possessed fully-developed, stylet-like mandibles, but the male had already lost these organs. The maxillary palpi were filiform. The venation was similar to that of *Pelecorhynchus*, except that the basal section of R_1 was at least indicated and may have been complete (cf. Alexander, 1927).^{*} Cell R_1 was longer, and vein 1A may not have been so sinuous. Squames were not or very slightly developed. The legs were armed with spurs on all tibiae, and the empodia were pulvilliform. Pubescence on the head and body was only slightly developed, and there were no macrochaetae nor scutellar spines. The abdomen of the female was broad at the base, and tapered fairly evenly, much as in *Chorista*, that of the male probably being narrower and straighter, while the terminal segments of both sexes were visible in repose. The eighth sternite was shovel-shaped in both sexes, the tenth tergite was well developed in the female, the cerci were two-segmented in the female, one-segmented in the male, and the aedeagus of the male was a membranous tube strengthened by chitinous struts. There was no basal appendage to the gonocoxite such as occurs in Nemestrinidae.

The larva may have been somewhat like that of *Chrysopilus* in general form, but with a non-retractile head, and possessing well-developed chaetae and possibly tubercles. The head capsule was incomplete, tentorial rods were developed, and eyespots were present. The maxillae and mandibles were separate, but beginning to show a tendency to work in conjunction. The larva was peripneustic, with the posterior spiracles enlarged and probably sunk in a chamber; they had separate stigmatic plates, each in its own felt-chamber.

The pupa was a pupa libera, again probably not unlike that of the Rhagionidae. It had large, well-raised thoracic spiracles; girdles of spines, increasing in size from before backwards, on the abdominal segments; and the eighth segment bearing a simple girdle, and a single pair of terminal processes representing the aster.

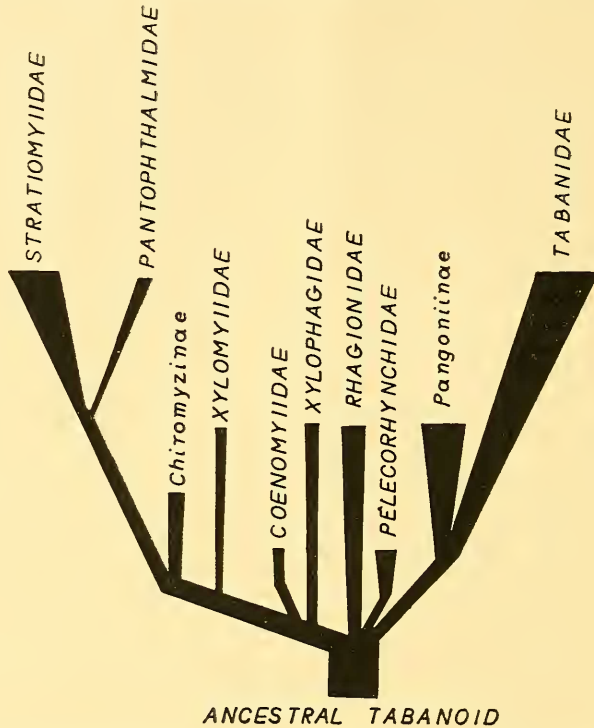
From this ancestral type there arose on the one hand forms with a characteristically somewhat humped thorax, a tendency to develop scutellar spines, reduction and simplification in the parts of the male hypopygium, and a larva with well-developed tegumentary appendages. These gave rise to the Xylophagidae and the Coenomyiidae, both of which, and especially the latter, show definite affinities with the Stratiomyiidae rather than the Rhagionidae. Further development along the same line led to the elimination of the free pupa, increased specialization in the integument and mouthparts of the larva (but retention of the non-retractile head), and a marked concentration and reduction of the venation of the adult. The mandibles of the female had already disappeared, and many forms showed additional indications of atrophy of the mouthparts. The Xylomyiidae and Chironomyiinae represent early branches from this line, which culminated in the more typical Stratiomyiidae, with the Pantophthalmidae as an offshoot near the top, so near that we are rather at a loss to know why it has been given separate family status.

The three remaining families all have larvae with a more or less retractile head, and share many other characters in common. They are much more closely linked to each other than any of them is to the Stratiomyiid line of development. From the "middle" stem the Rhagionidae developed. They show little indication of specialization in the adults, other than reduction in size, in mouthparts, in venation, and in complexity of the male genitalia. The larvae, however, as Bischoff (1924) has pointed out, range from the most simple to the most complex, in response to the diverse environments they occupy. The Pelecorhynchidae are easy to place, close to the base, nearer the Rhagionid than the Tabanid stem, and at about the same level of specialization as the Coenomyiidae, which adequately expresses the similarities between these two families. Finally, there is the Tabanid stem, distinguished by the characters of its larvae (p. 29), the presence of a pore connected with the thoracic spiracle of the pupa, specialization of the pupal aster, retention of functional mandibles in the female,

^{*} The Asilid genus *Promachus* is the only one we know of in the Brachycera which still has the basal section of R_1 complete.

reduction of the female cerci to a single segment, and the presence of well-developed flagella in the male genitalia, which, however, also occur, though less characteristically, in some Rhagionidae. The more primitive Pangoniinae, such as *Scaptia* and its allies, evolved only to a level comparable with the Rhagionidae, but many Tabaninae show quite as much specialization, both in the larvae and the adults, as do the Stratiomyidae.

An attempt to represent these relationships graphically is given in Text-fig. 51.



Text-fig. 51.—Diagrammatic representation of the evolution of the Tabanoidea.

4. BIOLOGY.

A. HABITS OF THE ADULTS.

Although the species of *Pelecorhynchus* have been described in various papers as blood-suckers, actually they are exclusively flower feeders. They occur in the vicinity of swamps, soakages, or creek banks in open, sunlit situations, usually in high, mountainous or tableland country, and species of the genus *Leptospermum* are practically the only flowers visited in Australia. *L. flavescens* Sm. is usually the favourite, although other species are often attractive in particular localities, for example, *L. lanigerum* Sm. in the Kiandra district. Occasionally specimens are taken feeding on the flowers of Epacrids or other low shrubs. *P. rubidus*, nov. may be quoted as an example of selective feeding. Numerous specimens of this species were taken at Blackheath, feeding on a small, white *Leptospermum* close to a swamp, none on Epacrids in the swamp, and only one on a large and apparently attractive area of *L. flavescens* Sm. less than a mile away.

When feeding, the fly comes completely to rest and remains some time, definitely longer than do Bombyliids or Nemestrinids, which just touch each flower and keep their wings vibrating rapidly. *P. distinctus* Tayl., members of the *fusconiger* series, and those species of the *personatus* group which have been taken on flowers, move about fairly rapidly, crawling from flower to flower of a cluster and sucking a little nectar from each, before flying off to seek another. *P. fulvus* Ric. and *P. mirabilis* Tayl. are much more sluggish, and often lie hidden for considerable periods in or beneath the flower clusters, so that quite a number may be present on a bush without being detected.

It is really remarkable that such large, richly coloured insects can be so inconspicuous. The greatest contrast with the usual habits is, however, seen in *P. tillyardi* Tayl. and *P. niger*, nov. These species have never been seen in flight, but bury themselves deeply in the flowers, and crawl about very slowly, looking, in fact, much more like long-bodied black beetles than flies.

Males are taken in company with the females on the flowers, or hovering in their vicinity. Occasional specimens have been found resting on shrubs or rocks away from the flowers. The males of *P. fusconiger* Walk. frequently hover in open, sunny spaces same distance from the flowers. When hovering, the males of some species, for example, *P. rubidus*, nov., remain motionless in the air, returning to the same spot after being disturbed, just as do the species of *Trichophthalma*. They are consequently not difficult to capture. The males of *P. fusconiger* Walk., on the other hand, never remain still, but swing sideways to and fro in the air all the time. When on the wing, the species of *Pelecorrhynchus* emit a loud, deep-toned hum, which is quite characteristic, and reminiscent of Tabanidae rather than the shrill, high-pitched note of Nemestrinidae.

Copulation is horizontal, the pairing individuals facing in opposite directions. Pairs *in copula* have been seen hovering, and also resting on the flowers.

While the habits of some species of the *personatus* group are similar to those described above, the Tasmanian species behave very differently, according to Mr. G. H. Hardy, to whom we are indebted for the following notes: "They have only been found in quantities over large areas of swamp. Most of the specimens have been taken resting on the ground, usually in the marsh, over which the males hover waiting for the females to rise; in flight they are swift, and they copulate on the wing. Prior to copulation, a female, with usually more than one male around her, soars to a great height, and the few pairs that have been taken *in copula* were captured away from the marsh at rest on shrubs. During the middle of the day they are so active that their capture is usually impossible, and they are best collected early in the morning or in the evening, when they are sluggish."

Mild temperatures and a high rainfall appear to be the main factors governing the appearance of the adults in any numbers. In localities where they are known to occur, they may be abundant one year, but scanty or absent in another, a dry spring apparently being unfavourable for emergence. Even when abundant, they are only active on bright sunny days, and very slight variations in weather seem to affect them. Thus, at Blackheath, *P. rubidus*, nov. was found in quantity one day, and the next, which was warmer and more windy, but few were seen until well on in the afternoon, although the best collecting time at flowers is usually from 11 a.m. to 3 p.m. On days, such as were met with at Barrington Tops, in which there were spells of bright sunshine alternating with showers of rain, they would take some time to appear after a shower, but would then come round in numbers and feed very eagerly, only to disappear immediately the sun went behind a cloud.

Very little has been written of the habits of the Chilean species, but, so far as they are known, they appear to be similar to those of their Australian relatives. We quote the following extracts: "On the forest road between Santo Domingo and Futa these beautiful flies (*P. biguttatus* Phil.) hovered two or three feet over the ground for a long time without settling; if I approached they darted away like an arrow and then came back again to the same spot." (Philippi, 1865.) "We obtained numerous specimens of each sex of this species (*P. elegans* Phil.) in early morning (7-9 a.m.) at flowers of a Saxifragaceous tree (*Escallonia pulverulenta*), in company with *Oscia lata* and *O. rufa*." (Footnote by F. W. Edwards in Kröber, 1930.)

Definite mimicry of other insects is rare in the Tabanoidea, though not unknown. Such precise mimicry of a particular model does not occur in the genus *Pelecorrhynchus*, but certain species do show a striking general resemblance to wasps or beetles, and these may be justly regarded as group mimics. Nicholson (1927) comments on two of them in the following terms: "The colouration . . . in a few cases approximates very closely to that of certain psammodontids, as in *P. deuqueti* Hardy (Pl. ii, fig. 16) and the undescribed species I have figured (Pl. ii, fig. 22).^{*} On flowers these insects may

^{*} *P. fascipennis*, nov.

easily be mistaken for wasps, though no special mimetic habits have been observed." *P. distinctus* Tayl. may also be classified as a general wasp mimic, but the other two species of the *fulvus* group behave differently, and tend to resemble beetles rather than wasps. Indeed, *P. fulvus* Ric. might well be included in Nicholson's "Metriorhynchus complex", although the colouration and habits are not quite typical. On the other hand, as mentioned above, *P. tillyardi* Tayl. and *P. niger*, nov. show a really remarkable resemblance to beetles both in behaviour and appearance. It is an interesting point that in most species, including the wasp mimics, the wing tips are well separated and the costal margins diverge at an angle of about 30°, but in *P. fulvus* Ric. the tips are brought much closer together, and in *P. tillyardi* Tayl. and *P. niger*, nov. they are closely approximated, the costal margins being parallel like elytra.

We have been unable to observe oviposition, either in the field or in the laboratory, nor have we succeeded in discovering the eggs. From the structure of the ovipositor and the situation in which the larvae occur, we suspect that the eggs are buried in moist soil or mud, either singly or in small groups. This suggestion is supported by the following notes: "Females found ovipositing in the perpetually damp mud of the track in People's Park" (Hardy, 1933, on *P. eristoloides*). "Mr. R. J. Tillyard took a specimen of this species depositing eggs in mud" (Hardy, 1917, on *P. albolineatus*).

B. LIFE-HISTORY.

Pelecorhynchus fulvus Ric.

Habitat.

The larvae of *Pelecorhynchus* were first found on the 14th October, 1934, at a small mountain plain, known as Blundell's, at the foot of Mt. Coree, A.C.T. A creek running along this valley widens into a small swamp, and in this region the larvae occurred. They were within one to three inches of the surface, in fairly firm mud closely bound with a mat of grass roots below a short turf. The main roots were white and glistening, and the larvae closely resembled them, often being difficult to detect. When only partly exposed by digging, they rapidly glided out of sight, but when turned out on the surface they were clumsy and squirmed helplessly until the head and thorax had burrowed into the ground.

On the 11th August, 1935, the swamp at Blundell's was under water and the creeks running high as a result of snow and rain during the winter, so a small area on the bank of the main creek opposite to the swamp was examined. The area was from one to four feet from the water, and consisted of saturated black mud with no vegetation. It yielded six larvae, lying from one to two inches below the surface, and ranging from small to half grown. The original spot, where the full-grown larvae were found the previous year, was inaccessible. Two weeks later, when the water had subsided, the original grassy area in the swamp was searched. Four larvae, none of which was full grown, were found, and two others were found in the muddy spot on the other bank.

On the 27th October, these two situations were dug over again, and a new place further down stream, where the larvae of *Scaptia auriflua* Don. occur, was searched. All were very moist, and yielded a total of ten larvae. A fourth site was then examined. This was on the lower, more swampy bank of the creek. It was a narrow bank between the creek and one of the swamps, being slightly elevated above the general level and only six inches to one foot from the edge of the swamp. Here, in an area of 4 ft. by 2 ft., sixty larvae and eighteen pupae of *P. fulvus* Ric. were found. The largest larvae measured over 50 mm. and were very close to the surface, while on digging to deeper levels the larvae became progressively smaller, the smallest (less than 25 mm.) being 4 to 6 inches below the grass. The bank sloped slightly upwards away from the swamp to drier soil, and here the pupae were common. In the soil of the same area were Tipulids, Stratiomyiids, Tabanids, and earth-worms.

The same bank was searched again on the 24th November, when forty-two larvae and two parasitized pupae were collected. On the 19th January, 1936, a further search was made, and larvae were still present, but not so abundant.

Several additional localities have been investigated. One was a creek with swampy banks, at the foot of Mt. Tidbinbilla in the same range as Mt. Coree. This area was examined in September, 1935, and numerous larvae were found in the same type of

situation as at Blundell's. They were present in the soil from the water's edge to well up the bank under the grass, and were of various sizes from very small to full grown. Three pupae were also found in the roots of a large tussock close to the water. As before, the larvae were associated with numerous earth-worms and Tipulid larvae.

A second locality was on a mountain range near Michelago, N.S.W., a small, sloping swamp on the shoulder of Mt. Tinderry (4,600 ft.), being examined on the 8th September, 1935. Several larvae and one pupa were found. They were close to a pool, in wet, muddy soil covered by dense, long grass with water seeping through it. Earth-worms and Tipulid larvae were also abundant here. The same swamp was again searched a month later, but, although Tipulid, Stratiomyid, and other dipterous larvae were common, no larvae of *Pelecorhynchus* could be found.

A third locality was at Mittagong, N.S.W., where a few larvae were dug out of the sloping bank of a creek in September and October, 1936. The type of country was different from that in which *Pelecorhynchus* larvae had been obtained previously. The creek drained sandstone country, and the soil in which the larvae were living contained a fair amount of sand, unlike the soft muddy soil at Blundell's and Mt. Tinderry. It was covered with grass, was moderately damp, and the larvae were amongst the grass roots. Larvae have also been collected near the laboratory, at Black Mountain, A.C.T. Only two have been found, one in August and the other in September, 1935. Both were large, and they were dug from a swampy area produced by the outflow from a septic tank. A careful search was continued throughout the area for many weeks, but no more could be discovered. The Mittagong and Black Mountain larvae were not bred through, but they were structurally identical with those of *P. fulvus* Ric., and the adults have been taken in both localities.

Behaviour.

The larva is rigid, and incapable of contraction like the softer-bodied Tabanids. The Tabanids shrink within themselves when handled, but *Pelecorhynchus* larvae writhe sideways, exerting considerable muscular force, and, being slippery and waxy to the touch, soon squirm through the fingers unless gripped very tightly. They move quickly through the mud, with a snake-like, sinuous glide, and also use the mouthparts in progressing forward. They cannot progress on smooth surfaces, or in water, but curl repeatedly into a circle on the same spot.

They were always found in association with earth-worms, but in many instances the larvae of Tipulids, Tabanids, and other Diptera were also present. It was assumed that the most likely food would be worms, and these were provided for the *Pelecorhynchus* larvae kept in the laboratory. The worms disappeared, and occasionally remains of them were seen in the jars, but only once was feeding observed, a large *P. fulvus* larva having its head buried in the side of a worm. Many larvae taken in the field were much scarred, the scars showing as dark brown patches and streaks on the shining whitish body. It is possible that they had been attacked by their fellows, but, as various Tabanid larvae sometimes occurred in the same habitat, they might have been attacked by them. The integument is so tough and slippery that it must be almost impossible for any other dipterous larva to make much impression on it.

Life-cycle.

Laboratory observations have so far given little information of value. It proved difficult to maintain suitable conditions for the larvae, and as a result many died, while others entered on more or less prolonged periods of inactivity; very few increased in size. Nevertheless, in some respects they appear to be very resistant to adverse conditions, as even young larvae are capable of remaining dormant for a long time. Starvation for many months will not kill them, provided they are kept reasonably moist, while, in the field, they survive burial under snow and subsequent flooding with icy water. On the other hand, desiccation caused rapid death, particularly of the smaller larvae. The prepupal period was unduly long in the larvae kept in the laboratory, pupation not occurring until mid-winter, despite the equable climate maintained.

The pupae are more delicate than the larvae, being affected both by too much moisture, which renders them waterlogged and liable to fungal infections, and by too

intense drying, which prevents emergence of the fly. As would be expected from the field situations in which they occur, they are less sensitive to drying than to saturation. Pupae have also been found infested with an undetermined hymenopterous parasite, and in the laboratory they were often damaged by the remaining larvae. Neither of these hazards would, however, appear to be of much importance in nature. The exact duration of the pupal period was not determined, but apparently recently-formed pupae collected in the field gave rise to flies after 30 to 56 days in the constant temperature room at 23°C. Only one of the larvae that pupated in the laboratory survived to produce a fly; this occurred 42 days after the pupa was found in the breeding jar and transferred to the constant temperature room.

The identification of the larvae was based on this specimen, on the identity of pupae formed in the laboratory with field specimens that gave rise to flies, and on the occurrence of the adults in the localities where the early stages were collected.

The adults that emerged were transferred to cages, and every effort was made to keep them alive and induce them to oviposit, but none lived more than seven days.

The number of instars is not known, but, in view of the rigidity of the skin and the length of the life-cycle, it is probably large. The prepupal skin when cast is resistant and easily found in the soil, but no skins of earlier instars have yet been found in the breeding jars.

Field observations have given much more information about the life-cycle than the laboratory studies. No eggs or newly hatched larvae have been seen, even in summer, and the smallest larva found, 13 mm. long, was collected in spring. Early in spring (August-September) no full-grown larvae could be discovered, those collected ranging from small to half and three-quarters grown, but in October and November full-grown larvae and pupae were abundant. Undamaged specimens, collected late in October in one situation at Blundell's, were measured, with the following results:

Larvae: less than 30 mm.	8
30 to 40 mm.	22
40 to 52 mm.	26
Pupae	18

As indicated earlier, the larvae of different sizes occupied different depths in the soil, with the very small ones deep down, where the moisture content is great, and the largest, which are ready to pupate, very close to the surface. In summer, when the adults have emerged, only pupal shells and parasitized pupae have been found, along with immature larvae; no full-grown larvae have been dug in summer or autumn.

These observations suggest that the full life-cycle is three years. The larvae less than 20 mm. long in spring are presumably those that were deposited as eggs the previous December and January, when the adults were on the wing. They probably grow rapidly in summer and autumn, and hibernate when the swamps and creek banks are under snow and water. Those between 20 and 40 mm. are no doubt the larvae which have hibernated twice, and the largest, taken in October and November, are the three-year old larvae, which are about to pupate. The appearance of these large forms immediately the weather warms up indicates that the final growth stage is fairly rapid. As pupae are found late in October and adults appear on the wing early in December, the pupal stage in the field probably lasts about six to eight weeks. The large larvae kept in the laboratory frequently remain dormant for many months to a year before pupating. This is doubtless due to the artificial conditions, but if it occurs in the field, as it well might during a drought, then the life-cycle could sometimes be extended for four years.

Other Species Studied.

P. nigripennis Ric.

The larvae were first collected at Alpine Creek, near Kiandra, N.S.W. The creek widens into small swamps amongst hilly country, and there are numerous swampy areas draining the surrounding slopes. Three species were found, but *P. nigripennis* Ric. occurred only in the wettest situations, having the nearest approach to an aquatic environment of any of the species so far discovered. It was dug out of the wettest mud in the centre of the swamps, and was also sieved from weedy, algal-covered pools. About forty specimens were collected in all. A few larvae of this species have also

been found at Blundell's, but not elsewhere. Two were collected in November, 1935, in wet mud at the edge of the swamp, close to the bank containing so many *P. fulvus* Ric., but in a decidedly wetter habitat. In the following January, three more were found under unusual circumstances. They were in a pool several inches deep in the middle of the large swamp, partly buried in the fur underneath a dead wallaby. Pupae have not been found in the field.

The larvae are distinguishable on sight, being slenderer, more pointed, and more translucent than the others. They are also more active, swimming freely in the water, lashing their bodies vigorously when handled, striking at each other, and attempting again and again to pierce the skin of the person handling them.

The larvae collected at Alpine Creek in November were kept in breeding jars at room temperature in the laboratory. Pupation occurred from the 2nd December to the 6th January, and emergence from the 21st to the 23rd January. The pupal period for specimens that actually emerged was 21 to 35 days, the shortest recorded for any of the species.

Pelecorhynchus rubidus, n. sp.

The larvae were found only at Alpine Creek, where they were confined to a particular situation, and were not as abundant as the other species, which were more widespread in the area. The majority were full grown, but a few were between 40 and 50 mm. in length. They occurred just under the short turf on a small flat which was distinctly above the general level of the swampy areas. In this circumscribed situation they were fairly numerous, twenty-six being taken, and they were associated with Scarab larvae and earth-worms, but no other species of *Pelecorhynchus* occurred there. While the soil could not be described as dry, it was certainly the least moist environment in which *Pelecorhynchus* larvae have been discovered. No pupae were found.

These larvae were very sluggish, lying inertly on the overturned soil and grass, and struggling very little when handled. Some were set aside for breeding in the laboratory, but they refused to feed on the earth-worms provided, and did not thrive. Pupation was very irregular, one larva pupating on the 19th November, a week after it had been collected, another in mid-March, and two more in October after lying dormant all the winter. Pupation was observed in one specimen, the only occasion it has been seen in the genus. A larva emerged on the surface of the soil, and the abdominal girdle of spines on the pupa became visible through the larval skin. It lay inert, with the thoracic region swollen and wrinkly, and the following day the pupa had formed and the larval skin was shed. The pupal period for the single adult that emerged was 35 days.

P. fusconiger Walk.

Larvae have only been found at Alpine Creek, where, like the adults, they are very common. In November, when they were collected, only two-thirds to full-grown larvae and a few pupae could be found. They were much more widespread through the area than *P. nigripennis* Ric. and *P. rubidus*, nov. occurring under short grass, in the roots of large grass tussocks, in mud or merely moist soil, near or far from water. In habitat, behaviour, and appearance they are closely similar to *P. fulvus* Ric., and cannot be distinguished from that species in the field, but it is a curious fact that neither larvae nor adults of *P. fulvus* Ric. have ever been taken at Alpine Creek. In the laboratory, pupation was delayed, as in other species, and the pupal period was about 30 to 40 days.

Unidentified Larvae.

In January, 1937, a search was made on the banks of the upper Tuross River, near Countegany, N.S.W. The small swamps and the type of soil were typical of sub-alpine country. In the soil covered with dense grass on the edge of one of these swamps, several larvae were found in company with *Scaptia* and other Tabanid larvae. They bore a resemblance to both *P. fulvus* Ric. and *P. fusconiger* Walk., being rather closer to the latter, although they were smaller and had a slightly broader terminal segment.

In April, 1937, two solitary larvae were found under separate pads of cow dung lying in a small, sloping patch of bog running down to the upper McDonald River, near Nimmitabel, N.S.W. The situation was unusual, and reminiscent of finding

P. nigripennis Ric. under a dead wallaby. However, this was a different species from any previously collected. In the manure were Calliphorid and Muscid larvae, and earthworms were abundant beneath.

Discussion.

The larval habitat of these primitive types is of special interest. In *Pelecorhynchus* the larvae have been found associated with swamps and creeks in alpine and sub-alpine country. They occur in the mud or soil, usually beneath a grass cover. The pupae are always in slightly higher or drier ground, sometimes in the crowns of large grass tussocks. There is a gradation in the different species from a nearly aquatic to a nearly terrestrial habitat. Of related groups, the Tabanid, *Scaptia auriflua* Don., occupies a similar environment to *P. fulvus* Ric., although they have only been taken together once, and the larvae of the Rhagionid, *Chrysopilus aequalis* Walk., also occur in similar situations. The early stages of the primitive Stratiomyiids, *Boreoides* and *Metoponia*, are found in somewhat drier, more sandy soil further from the water edge, their habitat overlapping the pupal habitat of *Pelecorhynchus*. Thus all these primitive Tabanoids occupy a generally similar environment, and in each of the families specialization has occurred in both directions, some species becoming terrestrial and others aquatic. There is reason, therefore, to suggest that the larval environment of *Pelecorhynchus* may be the ancestral environment of the Tabanoidea. It would follow that the various adaptations to special environments that occur in the Tabanoidea should all be considered as having evolved from a type which originally lived in that semi-aquatic environment.

5. DISTRIBUTION.

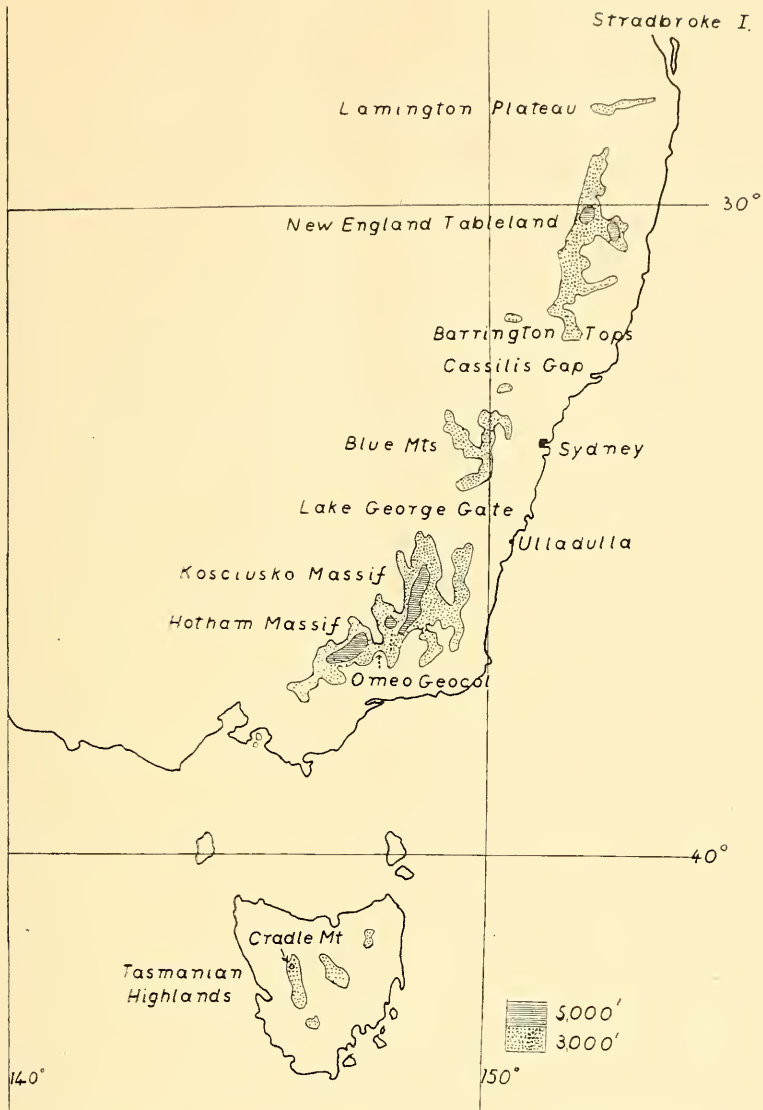
A. LOCAL DISTRIBUTION.

The area in Australia occupied by the genus *Pelecorhynchus* is very limited, and at the same time very typical of that of the "Antarctic" element in general. It is restricted to the main highland massif of Tasmania and to the eastern highlands of Victoria and New South Wales, together with certain small but important extensions to adjacent low-lying areas.

The Tasmanian fauna is the most isolated, and is very distinct from that of the mainland; it may therefore be considered first. Here the *personatus* group has its highest development, seven species having been recorded, of which six are endemic. These species are largely concentrated in the north-westerly part of the main central plateau, six being known from Cradle Mt. and its vicinity, while the seventh, *P. olivei* Hardy, which has so far only been taken at Strahan, will almost certainly be found there also. The southern end of the plateau would appear to be unfavourable for *Pelecorhynchus*, for only one species, *P. montanus* Hardy, has been collected at Mt. Wellington, while *P. eristoloides* Walk. occurs on the coast nearby. As would be expected, however, the chief coastal extension is to Zeehan and Strahan, four species being known from these localities; unlike that of the mainland, it takes place in the middle of summer.

On the other hand, the remaining groups are only represented in Tasmania by a solitary species, *P. fusconiger* Walk., which is restricted to a small area on the north coast, and is probably a casual invader from the mainland.

On the mainland, all the species of the *fusconiger* and *fulvus* groups are found, while the *personatus* group is fairly well represented, though not to the extent that it is in Tasmania. We have made some attempt to correlate the distribution of the species with the physiography of the Main Divide; the evidence is unfortunately scanty, but the problem is an interesting one, and it may be useful to make available what information we possess. The part of the Main Divide under consideration consists of four large, elevated blocks, separated by areas of less elevated country (Text-fig. 52). In the north, the New England-Dorrigo-Barrington Tops area is divided by the Cassilis Gap from the Blue Mountains massif, this in turn being separated from the Kosciusko plateau by the Lake George Gate. The Kosciusko area extends into Victoria, and is only separated from the Hotham massif in that State by the narrow Omeo geocol. To the east of the Kosciusko massif lies a smaller block which, however, does not concern us at present, as only outlying species occur there. All these areas rise more than 4,000 feet



Text-fig. 52.—Map of south-eastern Australia, showing the distribution of the main highland blocks and intervening gaps. The 3,000 and 5,000 ft. contour lines are shown.*

above sea level, the general level for the occurrence of *Pelecorhynchus* being between 3,000 and 5,000 feet.

It is doubtful whether any of the gaps forms a complete barrier, and it is certain that a number of the more adaptable species can cross them with ease, but it does seem probable that some species, which are more limited in seasonal occurrence, and possibly in choice of food plants or breeding grounds, have been relatively isolated on the different highland blocks. Moreover, the species of *Pelecorhynchus* are restricted to certain limited habitats, which can be easily recognized with experience, so that the actual degree of isolation is frequently much greater than is suggested by the contour lines. Thus there has been ample opportunity for the development of new and nascent species within relatively recent times, with results which are particularly apparent in the *fusciger* group.

* We are indebted to the Geography Department, University of Sydney, for permission to publish this map.

Each of the three groups is represented in all the areas, but only three species extend throughout the entire range from the Dorriggo to Victoria. These are *P. nigripennis* Ric. (which, incidentally, is the only mainland species established in the highlands of Tasmania), *P. fulvus* Ric. and *P. fusconiger* Walk. In addition, *P. claripennis* Ric. extends from Victoria to the Blue Mts., and *P. personatus* Walk. has a long coastal range, but the remaining species are distinctly more local in their distribution. Thus, *P. nebulosus*, nov., and *P. nero*, nov., two near allies of *P. claripennis* Ric., occur respectively in the Blue Mts. and at Barrington Tops, and the species of the *tillyardi* series have much the same distribution, while those of the *fascipennis* series are more southern, reaching their greatest development in the Kosciusko area, with one species extending south into Victoria, a second north to the Blue Mts., and a third (*P. taeniatus*, nov.) represented by a near ally in the Blue Mts.

The efficiency of the gaps in the Divide as barriers to the dispersal of the species has, in general, decreased from north to south, due no doubt partly to their physiological differences, but perhaps more to the changing climate and vegetation of the less elevated country in them. In addition, however, each of the two main gaps appears to have acted in a different way in relation to different species. For example, the Cassilis Gap isolates a series of very distinctive species to the north, but has proved no barrier to the typical form of *P. fusconiger* Walk., which is equally prevalent on either side of it. This species is divided by the Lake George Gate into its northern typical subspecies, and southern alpine subspecies and var. *rufibasis*, nov. The same line separates *P. taeniatus*, nov. from *P. fascipennis*, nov., but has had no detectable effect on *P. claripennis* Ric. or *P. dequeti* Hardy, near relatives respectively of *P. fusconiger* Walk. and *P. taeniatus*, nov. The salient features of each of the highland areas may be summarized in the following terms:

New England massif.—Ten species in all; two, *P. distinctus* Tayl. and *P. tillyardi* Tayl., very distinctive; one, *P. kippsi*, nov., whose nearest relative is in Tasmania; another, *P. simplissimus*, nov., related to a Kosciusko species; *P. interruptus*, nov. and *P. nero*, nov. with relatives in the Blue Mts.; and four species, including the rare *P. niger*, nov., which also occur elsewhere.

Blue Mts. massif.—Eleven species; three only are endemic, one, *P. linealis*, nov., being related to the Barrington Tops *P. interruptus*, nov., another, *P. fascipennis*, nov., to a southern species, and the third, *P. nebulosus*, nov., both to the northern *P. nero*, nov. and the southern *P. claripennis* Ric.; of the other eight, two are widespread, two range to the north, three to the south, and one, *P. personatus* Walk., does not occur elsewhere in the high country, but has a wide coastal distribution to the north.

Kosciusko massif.—Nine species and a variety, all either identical with or related to, species which occur further north; only two are endemic, and there is no special Tasmanian relationship in this area, such as is shown by *P. kippsi*, nov. in the New England massif.

Hotham massif.—Five species only have been recorded, all of which occur also on the Kosciusko massif; there is a doubtful record of a sixth (*P. personatus* Walk.); they are known from the higher part of the area, but also extend down to lower levels, where the Divide falls away towards Melbourne, this lowland extension occurring much later in the season than is the case further north.

The coastal distribution of the genus on the mainland may be divided into three parts, namely, Stradbroke I., Queensland, with extensions on the adjacent coast into New South Wales, the Sydney district, including the Hawkesbury sandstone heath country to the south, and Ulladulla on the South Coast (Text-fig. 52). The first is widely separated both from the other coastal areas and from the highland blocks defined above; it forms an isolated pocket, which, for some unexplained reason, is particularly rich in "Antarctic" Diptera. Three species of *Pelecorhynchus* occur there, *P. personatus* Walk., a distinctive subspecies of *P. fusconiger* Walk. and the remarkable *P. mirabilis* Tayl., which is found nowhere else in Australia. Six species are known from the vicinity of Sydney; all occur in the adjacent mountains, and all except *P. personatus* Walk. are

rare on the coast. They simply represent local extensions from the high country, as does the occurrence of *P. fusconiger* var. *rufibasis*, nov. at Ulladulla.

B. SEASONAL DISTRIBUTION.

Species of *Pelecorhynchus* are on the wing in midsummer in all the highland country, from the Dorriggo to Tasmania, but naturally tend to appear later in the season with increase either of altitude or latitude. On the coast, they are active in early spring (September) at Stradbroke I., distinctly later (October) at Sydney, and well into the summer in Tasmania. It is the usual thing to find "Antarctic" species on the coast of New South Wales in spring, and it has been pointed out previously that very similar conditions are found on the coast in spring to those occurring in the mountains in summer, namely, a mild climate, moisture, and an abundance of flowering plants, including species of *Leptospermum*. There is a good deal of evidence to suggest that the main factor governing the distribution of these "Antarctic" insects is a climatic one, competition with the Oriental element being of little or no importance.

In any area, the seasonal occurrence of certain species is apparently very limited. Thus, at Wentworth Falls on the 14th December three species were taken, and on the 21st December five species, three of which were not taken on the 14th, while one species taken on the 14th was not represented on the 21st. At Blackheath, eleven miles further on and about 600 feet higher, six species have been taken, four of which are not represented in the Wentworth Falls collection. There is little doubt that all will be found to occur at both localities when collected at the proper times. Similarly at Woodford *P. personatus* Walk. and *P. fusconiger* Walk. were taken in November, while at the end of January, *P. lineatus*, nov., was the only species seen. A corresponding seasonal succession has also been noted at Alpine Creek, near Kiandra, and is no doubt related to the differences which have been observed in the length of the last larval and pupal stages. In any event, the duration of adult life would rarely appear to be long.

C. GENERAL ZOOGEOGRAPHY.*

The genus *Pelecorhynchus* is only known from South America (Chile) and from Tasmania and south-eastern Australia. Its zoogeography, therefore, is simply that of the "Antarctic" element in the Australian fauna, an element which has frequently been discussed by Australian zoologists in the past, perhaps most notably by Harrison (1926), who found in the Wegener hypothesis of continental drift an adequate explanation of all the biological facts he could muster. In considering any explanation, however, certain facts about this element must be taken into account, and, as they are particularly well exemplified by *Pelecorhynchus*, they may be reviewed briefly here.

The first point is that the true relationships between the species from the two regions must be definitely established. This point was stressed by one of us (Mackerras, 1925) in an earlier paper on the Nemestrinidae, and was elucidated for that group by Edwards (1930), who showed clearly the close relationship between the South American and Australian species of *Trichophthalma* and its subgenera.†

In the present paper, we have demonstrated that an equally close relationship exists between the species of *Pelecorhynchus*, and the same could doubtless be said of other genera, which have not as yet been examined in so much detail. In neither of these groups, then, is there the remotest possibility of a chance resemblance due to convergence; we are definitely faced with a genuine and intimate genetic relationship.

The second point, which is particularly well illustrated by *Pelecorhynchus*, is that this genus has no very close relationship with groups from other regions. The subgenus *Ochlerotatus* (Culicidae) is Holarctic as well as southern in its distribution, while *Trichophthalma*, or even *Scaptia*, may have developed from northern forms, although they have radiated widely since; but *Pelecorhynchus* arose separately from the original

* The substance of this part was read before Section D, at a meeting of the Australian and New Zealand Association for the Advancement of Science held at Canberra in January, 1939.

† Through the kindness of Señor Carlos Stuardo O, we have been able to examine some Chilean species of *Trichophthalma*, and can confirm Edwards' findings from a study of the male and female genitalia.

Tabanoid stem, and, if it ever did have any Holarctic representatives, they have left no trace.

Thirdly, the local and seasonal distribution of *Pelecorhynchus* in Australia may be taken as typifying that of the "Antarctic" element in general. It is perhaps necessary to emphasize that this element is not merely a percentage of the total fauna of the country; it has a particular geographical and seasonal distribution of its own, which is so characteristic that the relationships of an animal may often be deduced simply from its local distribution. We do not wish to imply that the boundaries between the faunal elements are clear-cut and precise—there are, for example, Oriental species which occur on the mountain tops, and "Antarctic" species which have extended well into Queensland—but the parts of the country in which they dominate are perfectly well defined. That of the "Antarctic" element is the main eastern range from Tasmania to northern New South Wales, with a separate, isolated pocket (which, however, does not include *Pelecorhynchus*) in the south-western corner of Western Australia, another smaller pocket on Stradbroke I., and a fairly general coastal infiltration in the south-east from the adjacent mountains. In all these low-lying areas, the "Antarctic" species are on the wing only in spring.

It follows from the distribution defined above that these insects are adapted to live in a moist, temperate climate, and most of them are also associated with an abundant vegetation of flowering plants; indeed, many are restricted practically to the same limited environment as *Pelecorhynchus*. This genus seems to be quite incapable of resisting either high temperatures or even moderate aridity, and the same characteristic is shared to a greater or lesser degree by almost all the dipterous members of this faunal element.

In short, we have to explain the occurrence in Australia and South America of nearly related insects, which show no indication of origin from Old World forms (or at the least have undergone a marked development and radiation in the southern regions), which have a definitely limited distribution in southern Australia, and which are basically adapted to live in a temperate climate.

It is very difficult to reconcile these facts with any theory of radial dispersal from the Asiatic land mass. Too many assumptions are involved. We must assume that all these groups are in a state of retarded evolution, in order to account for the close similarity between the species at the ends of two long and widely separated radii of dispersal; we must assume that the representatives of many of the groups have disappeared completely from the northern centres, even from those which have a favourable climate, and that *all of them* have disappeared from the high, temperate areas in the long chain leading down from Asia to Australia, as well as from the northern part of Australia itself; and we must assume, too, either that the climatic changes from north to south in the past have been quite different from those which have been postulated by palaeogeographers on other grounds, or that the climatic adaptations of the insects have changed radically. These are but the more obvious of the assumptions which must be made, and collectively they seem to us to present insuperable difficulties to acceptance of a northern origin for this faunal element.

On the other hand, acceptance of a southern origin fits the biological facts perfectly. Moreover, there is evidence that the climate of Antarctica was formerly mild enough for the country to support an abundant vegetation, and presumably therefore an abundant insect fauna. According to Griffith Taylor (1919), climatic changes have taken place in major and minor cycles, which he describes as follows: "The minor cycles are superimposed on the major cycles in such a fashion that, after long ages of fairly uniform climate throughout the world, there appears a zonal arrangement of climates. This culminates at the four great ice epochs, that is in late Proterozoic, Devonian, Permian and late Tertiary times." It would thus seem that Antarctica had a suitable climate for the development of *Pelecorhynchus* and other southern groups early in the Tertiary, which would accord reasonably well with what little is known of the evolution of the Diptera Brachycera.

We may perhaps be justified, then, in suggesting that these groups, *Pelecorhynchus*, *Trichophthalma*, *Scaptia*, and a number of others, developed not in Australia nor in

South America but in this large Antarctic land mass, whence they radiated out to the adjacent countries, probably assisted and impelled in their migrations by the progressively increasing frigidity which developed towards the end of the Tertiary. There would thus have been a radiation northward from the south, just as in other groups there has been a radiation southward from the larger northern land masses, as described by Matthew (1906). This explanation would account, too, for a considerable section of the "endemic" fauna, groups like *Exeritoneura* and the brown species of *Calliphora*, which have no close relatives elsewhere to indicate their origin, and which have a geographical and seasonal distribution similar to that of the Antarctic element. It may be supposed that these also developed in Antarctica, but had only reached one of the adjacent countries before changes in climate and physiography broke the connections.

This hypothesis is very plausible, but it presents one great difficulty, and that is to bridge the gaps between Antarctica and the surrounding countries. There is apparently no geological or bathymetrical evidence for the existence of past land bridges, and the only remaining hypothesis which meets the conditions is that of Wegener (1924). It satisfies at any rate many of the geophysical and geological requirements, and it meets the biological facts we have discussed equally as well as those considered by Harrison. We may accept it provisionally as a sound working hypothesis from the biological point of view, leaving it to the geologists to substantiate or modify it or to propose a satisfactory alternative.

6. SYSTEMATIC REVISION.

A. GENERAL.

We have hesitated long before creating a new family; but the general acceptance of such annectant families as Coenomyiidae and Xylophagidae leaves us no alternative if we are to be consistent, for the genus *Pelecorhynchus* occupies a precisely similar position between the Rhagionidae and Tabanidae to that filled by these other families between the Rhagionidae and Stratiomyiidae. Moreover, both the true Rhagionidae and Tabanidae are well-defined, compact groups, which are distinguished from *Pelecorhynchus* by characters too important to be ignored. It might be suggested that the adults of *Pelecorhynchus* could be associated with Coenomyiidae or Xylophagidae (*sensu lato*) by the common possession of numerous primitive characters. As, however, they belong to a different line of evolution and their early stages are quite different, such an association would be unnatural and incongruous.

Family PELECORHYNCHIDAE, n. fam.

Pelecorhynchinae, Enderlein, 1925, p. 261 (subfamily of Tabanidae).

Monotypic for the genus *Pelecorhynchus* Macquart, 1850.

Adult.

Robust, ornate flies. Antennae subulate, porrect; third segment with eight clearly defined annuli. Thorax (and head) with long silky hairs, forming conspicuous tufts. Tibial spurs present. Wings with C continuous round margin; Rs long; cell R_4 wide, of medium length; M 4-branched; cell Cu_2 open, vein 1A sinuous; alula developed. Antisquame small, with a conspicuous tuft; squame very small or absent, when present it is attached only at extreme lateral end of squamal ridge. Abdomen with segments 1 to 4 normal, remainder tubular, telescopic, very extensible. Male hypopygium prominent; aedeagus with separated elements. Female with two-segmented cerci.

To be distinguished from related families as follows:

Tabanidae: By the small or rudimentary squame; presence of an infra-scutellar hair tuft; open cell Cu_2 and sinuous vein 1A; extensible, telescopic abdomen; male hypopygium; presence of two-segmented cerci in female.

Rhagionidae: By the large size and robust build; subulate, 8-annulate third antennal segment; presence of long silky hairs aggregated into tufts; scutal and abdominal adornment; relatively short cell R_4 and sinuous vein 1A; and by the male genitalia.

Of the remaining Tabanoid families, Coenomyiidae resemble Pelecorhynchidae in general body form, open cell Cu_2 , and sinuous vein 1A, but are devoid of hair tufts and are otherwise different by reason of their Stratiomyiid affinities.

Larva.

Large, extremely elongate, hard, rigid, incapable of contraction, tapering at ends; entirely smooth, waxy, shining, lacking projections or locomotor organs; thoracic hairs minute, some microchaetae also present on first thoracic and last abdominal segments; series of gland openings on abdominal segments. Head narrow, retractile; antennae large, two-segmented; labrum and labium complex, prementum present; mandible and maxilla working in conjunction, mandible curved, sharply pointed, lacking a pore. Amphineustic, anterior spiracles small; posterior pair separated, lying in a shallow cavern at apex.

To be distinguished from related families as follows:

Tabanidae: By the general form of the body; absence of projections, rugose patches and striations; form of spiracles, absence of siphon; absence of Graber's organ; type of mouthparts and method of feeding.

Rhagionidae: By the size, rigidity and smoothness; form of eighth abdominal segment and spiracular cavern.

The larvae have no Stratiomyid characters, and are consequently widely separated from Coenomyiidae and Xylophagidae (*sensu lato*).

Pupa.

Large, integument thick. Thorax short, wings and legs not extending beyond first abdominal segment; thoracic spiracle with straight transverse slit; head armature absent. Each abdominal segment except first with a girdle of spines; two dorsal and sometimes two ventral thorns anterior to girdle. Apical segment with six large thorns in position of girdle and a pair of large apical projections.

To be distinguished from related families as follows:

Tabanidae: By the thoracic spiracle, absence of thorns on abdominal segments anterior to girdles, structure of terminal segment.

Rhagionidae: By size, absence of thorns anterior to girdles, and armature of terminal segment.

Coenomyiidae and Xylophagidae: By the structure of the antennae, girdles and terminal segment.

Genus PELECORHYNCHUS Macquart.

Pelecorhynchus Macquart, 1850, p. 28; * Ricardo, 1900, p. 101, 1910, p. 402; Surcouf, 1921a, p. 221, 1921b, p. 110; Enderlein, 1925, p. 262. Genotype: *P. maculipennis* Macquart, 1850 (= *Silvius personatus* Walker, 1848).—*Caenopnyga* Thomson, 1868, p. 449. Genotype: *C. maculipennis* Thomson, 1868 (= *P. maculipennis* Macquart, 1850).—*Coenura* Bigot, 1857, p. 286; Enderlein, 1925, p. 262; Kröber, 1930, p. 113. Genotype: *C. longicauda* Bigot, 1857.

Adult.—Characters of the family, with in addition: Eyes bare, facets subequal, ocelli present; face prominent, strongly convex, separated from parafacials by a deep cleft; proboscis not longer than head, thick, with large, hatchet-shaped labella; palpi extremely short, about one-sixth of the length of the proboscis, second segment normally short, broad, and bearing a shallow, wide-mouthed apical pit. Infra-scutellar tuft present. Scutum and abdomen frequently with a conspicuous pattern. Fore tibiae unarmed, mid and hind tibiae each with a pair of apical spurs. Vein R_1 without rudiment of its basal section (appendix). Eighth sternite and ninth tergite of male large, heavily chitinized, and characteristically shaped; distal end of gonocoxite formed into a lobe, spine, or hood dorsally; style trilobed; aedeagus with a pair of stout, heavily chitinized apical hooks. Female with tergite 10 rudimentary, and second segment of cerci pedunculated.

Larva and pupa.—Characters of the family.

Synonymy: The genera *Pelecorhynchus* and *Caenopnyga* were originally monotypic, and were founded on the same genotype, *Caenopnyga* thus being an absolute synonym of *Pelecorhynchus*. *Coenura* was also originally monotypic, but founded on a different species; reasons have been given above (pp. 25–26) for regarding its genotype as congeneric with that of *Pelecorhynchus*.

* The references given in this paper to Macquart's works are to the reprints and not as they appeared in *Mém. Soc. N. Sci. Lille*.—Ed.

Within the genus, the species fall into three natural groups, which may be defined as follows:

personatus group: Sexes similar; scutum never with sharply defined yellowish dorso-central lines; wings with or without dark markings, but never with a bright flavid tint; abdomen tomentose dorsally and ventrally, but never orange in colour, always fasciate, and frequently with a median dark vitta, but never with lateral dark vittae. Australian.

fulvus group: Marked sexual dimorphism; abdomen of ♂ tomentose dorsally, orange, with median and lateral dark vittae, never fasciate; abdomen of male bare or tomentose as in *fusconiger* group; scutum of both sexes with yellowish dorso-central lines. Australian.

fusconiger group: Sexes similar; scutum variable, several species with creamy to yellow dorso-central lines; wings variable, frequently with bright orange tint or markings; abdomen usually bare and shining; if tomentose (Chilean species) the basal segments are never fasciate and the markings are reduced to white spots. The following series may be recognized in this group:

fusconiger series: dark species, with shining bare abdomen and lightly infuscated wings which are often suffused anteriorly with orange. Australian.

vulpes series: abdomen densely pubescent, apparently not shining, otherwise as in *fusconiger* series. Chilean.

longicaudus series: black species, with sharply defined, creamy to yellowish dorso-central lines, and more or less flavid, unspotted wings; abdomen with at least traces of tomentum and of white patches dorsally and ventrally. Chilean.

fascipennis series: wasp-like species, with yellowish antennae, orange wings patterned with black, yellowish tarsi, and bare abdomen. Australian.

tillyardi series: narrow-bodied black species, with blackish wings. Australian.

It is to be emphasized that these groups and series are based on markings and colouration. There are no structural differences between them to justify generic or subgeneric subdivision. It may be noted also that larvae and pupae of species from each of the three groups have been discovered, but show no differences which would support subdivision.

B. THE ADULTS OF THE AUSTRALIAN SPECIES.

Key to the Species.

Note.—The key is designed purely for quick identification; it does not necessarily indicate relationships.

1. Abdomen tomentose, orange with black vittae 2
 Abdomen tomentose or bare, but never as above 4
2. Median area of scutum orange; wings orange, with a black mark near the tip *fulvus* Ric. ♀
 Median area of scutum black; wings not as above 3
3. Large species; femora and tibiae bright brown; wings with two large dark patches anteriorly *distinctus* Tayl. ♀
 Small species; femora and tibiae dark brown to black; wings grey, with small black spots *mirabilis* Tayl. ♀
4. Abdomen tomentose dorsally and ventrally, with a well-developed pattern on the dorsum (obscure in *P. igniculus*) 5
 Abdomen devoid of tomentum or pattern, shining, usually black 18
5. Wings with dark spots, arranged in groups 6
 Wings uniformly greyish, at most with an obscure darker mark at the apices of the basal cells 12
6. A very small species, with orange antennae and yellow tarsi *mirabilis* Tayl. ♂
 Larger species, with dark antennae and concolorous legs 7
7. Abdominal pattern very obscure, tergites with conspicuous red hair; wing spots small but discrete *igniculus* Hardy
 Abdominal pattern clearly defined, red hair, when present, less conspicuous; wing spots larger 8

8. Pale abdominal fasciae complete, dark fasciae partly interrupted by a pale median indentation; wing spots large and conspicuous 9
Abdomen with a median dark vitta, or the dark fasciae confluent centrally, thus interrupting the pale fasciae; wing spots smaller and duller 10
9. Wing spots blackish and confluent; the pale fascia of the second visible abdominal tergite wide; lateral hairs of scutum and base of ruff reddish *nigripennis* Ric.
Wing spots usually more broken, smaller, and brownish; the basal pale fascia of the second visible abdominal tergite narrow; hairs at sides of scutum dark, base of ruff yellow *personatus* (Walk.)
10. Dark abdominal fasciae confluent in middle, and enclosing a conspicuous white spot at the centre of each segment *olivei* Hardy
Abdomen with a median black vitta, not enclosing a series of white central spots 11
11. Dorso-central lines of scutum black, enclosing a white spot at the suture; infra-scutellar and abdominal hairs red *eristaloides* (Walk.)
Dorso-central lines black, enclosing a white line which ends posteriorly at the suture; infra-scutellar and abdominal hairs pale gold *albineatus* Hardy
12. Abdomen with a median black vitta interrupting the pale fasciae 13
Pale fasciae complete, the dark fasciae may be partly interrupted by pale median indentations 16
13. Pale parts of abdomen reddish-brown, with reddish hairs at margins and apices of tergites and at apices of sternites; infra-scutellar tuft reddish-orange *rubidus*, n. sp.
Abdomen devoid of reddish tint or hairs; infra-scutellar tuft golden 14
14. Dorso-central lines narrow, pale, complete; median area of scutum black *kippsi*, n. sp.
Dorso-central lines wider, black, with a pale spot at suture; median area of scutum grey 15
15. Posterior margin of scutum with a median black triangular spot, which is continuous with the black central mark of the scutellum; ♂ hypopygium as in Text-fig. 58
..... *occidens* Hardy
Median part of posterior margin of scutum entirely pale; ♂ hypopygium as in Text-fig. 57 *montanus* Hardy
16. Pale parts of abdomen reddish-brown, with reddish hairs at margins and apices of tergites and at apices of sternites, black fasciae of disc narrow; ♂ hypopygium as in Text-fig. 59 *rubidus* var. *avittatus*, n. var.
Abdomen fawn, red hairs, when present, inconspicuous and never at apices of sternites 17
17. Dark abdominal bands broad, black, partially interrupted at centre; infra-scutellar tuft orange-red; wing with a faint dark cloud over the apices of the basal cells; ♂ hypopygium as in Text-fig. 60 *simplex*, n. sp.
Dark abdominal fasciae narrow, brown, fading into the pale fasciae, not indented; infra-scutellar tuft golden; wing without dark cloud *simplicissimus*, n. sp.
18. Wings dark grey, infuscated with black 19
Wings orange-yellow, usually with a well-defined dark pattern 20
Wings greyish, subhyaline, often lightly suffused with yellow 25
19. Median area of scutum grey, with a narrow black median line; ruff and lateral scutal hairs grey *tillyardi* Tayl.
Median area of scutum black, with narrow pale dorso-central lines; ruff and lateral scutal hairs red *niger*, n. sp.
20. Wings more or less infuscated with black distally, and with a black mark near tip; median area of scutum orange *fulvus* Ric. ♂
Wings with a definite black pattern; median area of scutum various 21
21. Scutum grey, with inconspicuous markings; wings with the tip and a broad band across the middle black 22
Scutum with conspicuous pale dorso-central lines; wing pattern not as above 23
22. Wings black at base; femora black; abdominal hairs grey *fascipennis*, n. sp.
Wings orange at base; femora bright brown; abdominal hairs dull orange-yellow
..... *taeniatus*, n. sp.
23. Median area of scutum dull fawn; femora yellowish-brown (wing as in *P. flavipennis*) *deuqueti* Hardy
Median area of scutum black; femora black 24
24. Wing with two extensive black patches anteriorly, the larger sub-basal and the smaller sub-apical *distinctus* Tayl. ♂
Wing with more or less confluent dark spots running in series across its apical half *flavipennis* Ferg.
25. Scutum black, with prominent pale dorso-central lines 26
Scutum brown, pale dorso-central lines obscure 27
26. Dorso-central lines complete; sides and ruff reddish *lineatus*, n. sp.
Dorso-central lines interrupted; sides and ruff black *interruptus*, n. sp.
27. Ruff and post-mesopleural tuft red to russet 28
Ruff and post-mesopleural tuft yellow to creamy 29

28. Abdomen with red tufts among the black lateral hairs *nebulosus*, n. sp.
 Abdomen with white tufts among the black lateral hairs *aero*, n. sp.
 29. Abdomen dark mahogany, with red lateral hair tufts *claripennis* Ric.
 Abdomen black, with white to yellowish lateral hair tufts *fusciger* (Walk.)

Key to subspecies and variety of P. fusciger Walk.

1. Supra-alar tuft red var. *rufibasis*, n. var.
 Supra-alar tuft creamy to dull yellow 2
 2. Antennae and legs entirely black, face with pale hairs only subsp. *alpinensis*, n. subsp.
 Antennae partly reddish-brown, fore and mid tibiae and tarsi brown, face with black hairs
 more or less mixed with pale ones 3
 3. Scutum grey, dorso-central lines prominent, lateral hairs bright yellow
 subsp. *fergusoni* Hardy
 Scutum dull brown, dorso-central lines faint, lateral hairs dark mixed with some dull yellow
 subsp. *fusciger* (Walk.)

The personatus group.

PELECORHYNCHUS PERSONATUS (Walker).

Silvius personatus Walker, 1848, p. 192.—*Dasybasis personatus* Walker, 1854, p. 267.—*Pelecorhynchus maculipennis* Macquart, 1850, p. 28, pl. ii, fig. 6; Ricardo, 1900, p. 102, 1910, p. 403; Froggatt, 1911, p. 9; Taylor, 1917, p. 513; Surcouf, 1921a, p. 221, 1921b, p. 111; Enderlein, 1922, p. 336, 1925, p. 262.—*Caenophnyga maculipennis* Thomson, 1869, p. 450, pl. ix, fig. 2.—*Pelecorhynchus ornatus* Schiner, 1868, p. 98; Williston, 1895, p. 192.—*Pelecorhynchus nigripennis* Taylor, 1918, p. 55, *nec* Ricardo, 1910, p. 405; Taylor, 1919, p. 41.—*Pelecorhynchus personatus* (Walk.), Ricardo, 1900, p. 102; Hardy, 1920, p. 35, 1922, p. 196, 1933, p. 412.

An ornate species; thorax with complete pale dorso-central lines, which are confluent posteriorly; abdomen with complete pale, and partly interrupted black fasciae;* wings with conspicuous irregular dark brown bands, often having the appearance of rows of more or less confluent spots.

♂, ♀. Antennae dark brown. Eyes contiguous for a considerable distance in the ♂, separated by a distance equal to about two-thirds of the length of the frons in the ♀. Frons with dark brown tomentum and black hairs. Face with silvery-grey tomentum, tinged above with brown; hairs black. Parafacials with creamy-white tomentum and white hairs, which are mixed with yellow ones in the ♂ and black in the ♀. Ruff pure white to creamy-yellow.

Scutum mainly black, with conspicuous pale grey markings and some more obscure brown areas. Dorso-central vittae pale grey, and fairly broad, and becoming confluent posteriorly, so that the posterior third of the median area is entirely grey. A narrow, median, almost white line is just visible on the grey, and frequently extends a little anteriorly onto the brown. Anterior two-thirds of the median area black, brown in the middle and at the edges. Sutural line grey, sharply delimited posteriorly, more diffused anteriorly. Presutural sublateral area black, becoming diffused through brown into grey posteriorly and into grey laterally. Postsutural sublateral area black, with brown to greyish centre. Scutal hairs black mixed with some russet hairs in front of the scutellum. Lateral hairs mainly black, mixed with a few creamy hairs anteriorly, and with a definite but narrow zone of red hairs above the wing root. Post-alar tuft conspicuous, dull creamy in colour. Scutellum jet black; infra-apical tuft dull red, mixed with a few black hairs. Post-mesopleural prominence brown, with black hairs. Post-mesopleural tuft creamy to pure white, as is also the relatively conspicuous tuft on the squame.

Legs uniformly dark brown, becoming blackish on the distal tarsal segments.

Wings greyish, sub-hyaline, with a series of prominent, oblique, irregular, dark brown markings. Cells C and Sc are uniformly brown. The basal marking fills the base of cells R and M; the second extends from the tip of Sc irregularly backwards to Cu₁, m-cu lying in the middle of its posterior part; the third extends obliquely across the distal part of the wing, with the bifurcation of R₄₊₅ for its centre, while the last almost fills the apex of the wing. In addition, there is an elongate, rather paler spot covering the

* "Fascia" is used throughout to mean a transverse band and "vitta" to mean a longitudinal stripe.

apical part of 1A and almost continuous with the second band, and there is also an oblique mark midway between the second and third bands covering the bifurcation of M_{1+2} and extending along r-m and M_3 to the wing margin. The extent of these markings is variable; in some specimens they form almost complete bands, while in others they are reduced to rows of more or less confluent spots, which in some individuals do not extend as far towards the hind border of the wing as in others.

Abdomen with the anterior half of each segment pale grey and the posterior half black. The grey fasciae are infuscated with darker grey to brownish anteriorly and towards the middle, while the black fasciae are interrupted in the mid-line for about two-thirds of their depth by a pale grey indentation, which is at least as deep as wide and usually distinctly deeper than wide. Abdominal hairs black, with a distinct admixture of reddish hairs on the posterior border of the second and subsequent visible tergites. Lateral tufts black and white in alternating areas corresponding to the markings on the disc.

♂ hypopygium (Text-fig. 53): Ninth tergite as broad as long; eighth sternite also relatively short and wide, its distal end not produced to form thumb-like projections on either side of the cleft. The dorsal lobe of the gonocoxite is neither greatly expanded nor abruptly truncated; style with the medial lobe small and truncated, intermediate lobe hardly projecting beyond the medial, its distal edge straight, lateral lobe nearly straight and of moderate size. Aedeagus with proximal struts longer than the distal part; hooks well developed, and strongly and evenly curved, the spines on their medial sides well developed and the space behind the spines slightly expanded.

Length: 16 to 17.5 mm.

Distribution.—Type ♀, New South Wales; Victoria and between Sydney, N.S.W., and Moreton Bay, Qd. (Ricardo). Queensland (Williston). Auckland, N.Z. (Schiner). The last record is almost certainly erroneous. We have seen specimens from the following localities:—Queensland: Stradbroke I., 2.x.1911 and 17.ix.1915 (Hacker), ix.1926 (Mackerras); Sunnybank, near Brisbane, x.1927 (Hardy). New South Wales: Gosford, x.1924 (Gallard); Pittwater, Hawkesbury River, 17.x.1926 (Mackerras); Narrabeen, 24.x.1926 (Mackerras); Manly, Sydney, 27.x.1923; Roseville, Sydney, 3.x.1923 (Ferguson); La Perouse, Sydney, 6.x.1918 and 12.x.1919 (Hardy); Sublime Pt. near Bulli, 11.xii.1925 (Harrison); Woodford, 14.xi.1925 and 7.xi.1926 (Nicholson); Wentworth Falls, 21.xii.1923 (Harrison), 11.xii.1926 (Mackerras) and 11.xii.1931 (Taylor); Blackheath, 18.xi.1919; Ropes Creek, no date; Burradoo, no date.

P. personatus Walk. was the first species of the genus described and was designated as the genotype by Miss Ricardo, who, however, for some reason used Macquart's name in preference. The types are in the British Museum. It is very close to *P. nigripennis* Ric., from which it may be distinguished by the characters listed under that species. *P. personatus* Walk. is very widely distributed, extending from Victoria to Brisbane, Qd., and is one of the few species occurring near sea level at Sydney. It is fairly abundant throughout its range, and is almost always taken feeding on *Leptospermum* flowers, but may occasionally be seen hovering over swampy areas.

PELECORHYNCHUS NIGRIPENNIS Ricardo. Pl. i, fig. 1.

Pelecorhynchus maculipennis Ricardo, 1900, p. 102, *nec* Macquart, 1850, p. 28.—

Pelecorhynchus nigripennis Ricardo, 1910, p. 405; White, 1915, p. 22; Hardy, 1915, p. 60, 1917, p. 63; Taylor, 1918, p. 55; Hardy, 1920, p. 36; Surcouf, 1921a, p. 222, 1921b, p. 111; Enderlein, 1925, p. 262; Tillyard, 1926, p. 359, pl. xx, fig. 21; Hardy, 1933, p. 412.

♂, ♀. Closely allied to *P. personatus* Walk., but darker and more conspicuously marked. The hairs on the parafacials have a more reddish tinge, and there is a tinge of red in the ruff and the post-mesopleural tuft. The sublateral areas of the scutum are entirely black, and the sutural line is faint; the reddish hairs at the side of the scutum are more conspicuous and more extensive, being continuous from the anterior margin of the thorax to the anterior portion of the post-alar tuft; the infra-scutellar tuft is a brighter red. The dark markings of the wings are blacker, and usually more extensive. The pale band on the second abdominal tergite is distinctly wider, occupying about two-

thirds of the width of the tergite; the pale median indentations of the black bands on all segments are wider than broad; also the line of red hairs at the apex of each tergite is more conspicuous. The male genitalia resemble those of *P. personatus* Walk., except that the hooks of the aedeagus are distinctly longer and less upturned, the spines on their medial sides are undeveloped, the distal part is as long as the struts, and the dorsal lobe of the gonocoxite is more expanded.

Length: 13 to 14 mm.

Distribution.—Type ♂, New South Wales; type ♀, Dandenong Ranges, Victoria. New South Wales: Ebor, 20.xii.1911; Barrington Tops, 7.ii.1925; Moss Vale, xii.1904 (Goldfinch); Ranelagh, 24.i.1915 (Lucas); Alpine Ck., near Kiandra, 2.i.1932 (Willings). Victoria: Healesville, 19.i.1896; Warburton, no date; Yarra Junction, 9.iii.1913. Tasmania: Ranelagh, 24.i.1915 (Hardy); Cradle Mt., 21.i.1925.

It is difficult to decide whether *P. nigripennis* Ric. and *P. personatus* Walk. are to be treated as separate species or as subspecies, for, although their ranges overlap considerably, *P. nigripennis* Ric. is distinctly more southern, and they have never both been taken in the same locality. On the whole we consider that the differences recorded are too great for them to be included within the one species. The habits of *P. nigripennis* Ric. are similar to those of *P. personatus* Walk., but it is distinctly rarer. Its life-history and early stages are described on pp. 36–37.

PELECORHYNCHUS OLIVEI Hardy.

Pelecorhynchus olivei Hardy, 1933, p. 413, 1940, p. 486.

A medium-sized species; thorax with complete pale dorso-central lines, which are not confluent posteriorly; abdomen with the paler portions forming incomplete lateral fasciae and a median diamond-shaped spot; wings spotted.

♂, ♀. Antennae dark brown to black. Eyes contiguous for a short distance in the ♂, separated by a distance equal to, or slightly greater than, the length of the frons in the ♀. Frons with dark brown tomentum and black hairs; face and parafacialia silvery-grey, with black hairs, mixed below with some yellowish hairs. Ruff creamy-yellow, becoming darker and duller yellow posteriorly.

Scutum dark brown to black, with prominent pale grey dorso-central lines, which widen out posteriorly in a few specimens, but do not become confluent. There is a median grey line, which widens out posteriorly, and extends forward for about one-third the length of the scutum. The suture is indefinitely marked with grey. Hairs of disc black, mixed at the margins with dark yellow; there is a zone of dark yellow hairs above the wing root, and the post-alar tuft is white, tinged anteriorly with yellow. Scutellum black, tinged anteriorly with grey or brown; infra-scutellar tuft orange-red. Post-mesopleural prominence with dark yellow hairs; post-mesopleural tuft white, tinged with yellow at the base. Squame with dark yellow hairs. Legs brown, becoming darker distally. Wings with distinct brown markings, the distribution of which is essentially the same as in *P. personatus* Walk., but the spots are much smaller and more discrete.

Abdominal tergites with dark brown to black basal and apical fasciae, which broaden out and coalesce near the mid-line, thus dividing the intermediate pale fascia into an elongate lateral area on each side and a large median, irregularly quadrangular, frequently diamond-shaped, spot. Hairs on disc black; a fringe of bright golden hairs at the apices of the tergites; marginal hairs in black and white alternating areas, the black being mixed with bright golden hairs, which almost completely replace the darker hairs posteriorly.

♂ hypopygium: Differs from that of *P. personatus* only in that the dorsal lobe of the gonocoxite is more square-ended, and the intermediate lobe of the style is more rounded and projects a little beyond the medial lobe; the hooks of the aedeagus are intermediate in size and shape between those of *P. personatus* Walk. and *P. nigripennis* Ric.

Length: 12 to 13 mm.

Distribution.—Tasmania: Only known from the type series from Strahan, ii.1924 (Hardy), of which we have seen several specimens.

P. olivei Hardy is to be distinguished from all other species of the group by the abdominal markings, the median pale spots being quite distinctive. Its nearest ally is

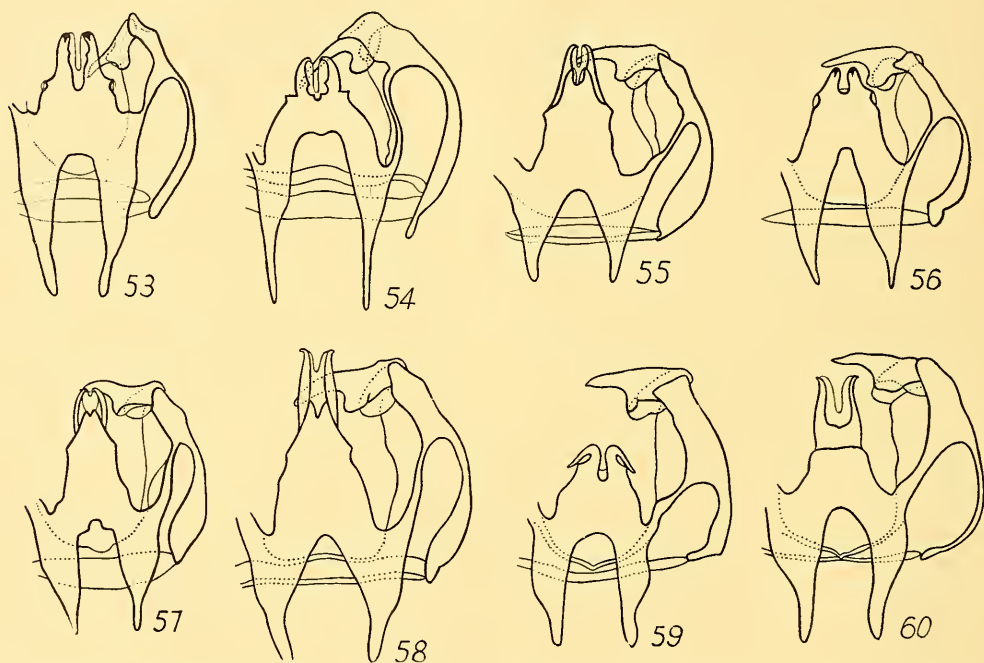
P. personatus Walk. which it links with *P. albolineatus* Hardy and other spotted-winged members of the group. It would appear to be swamp-frequenting in habits.

PELECORHYNCHUS IGNICULUS Hardy.

Pelecorhynchus igniculus Hardy, 1917, p. 64, 1920, p. 34, pl. ix, fig. 1; Enderlein, 1925, p. 262; Hardy, 1933, p. 413.

A distinctive reddish species; thorax with distinct pale dorso-central lines, ending posteriorly near the suture; abdomen red haired, with hardly perceptible markings; wings spotted.

♂, ♀. Antennae brownish-black. Eyes separated in the male by nearly the width of the anterior ocellus, in the female by a distance about equal to the length of the frons. Frons brown, with a darker brown blotch on each side of the middle in the female; hairs black. Face brown, with black hairs; parafacials creamy, with creamy-yellow hairs. Ruff dull creamy-yellow.



Text-figs. 53-60.—Male hypopygia of species of the *personatus* group. 53. *P. personatus* Walk. 54. *P. igniculus* Hardy. 55. *P. albolineatus* Hardy. 56. *P. kippsi*, n. sp. 57. *P. montanus* Hardy. 58. *P. occidentis* Hardy. 59. *P. rubidus*, n. sp. 60. *P. simplex*, n. sp.

Scutum dark brown, with prominent greyish dorso-central lines, bordered with black, and expanding at the suture, a little behind which they disappear; there is a narrow median lighter brown line, which becomes wider and greyish in colour in front of the scutellum; sutural line indefinite. Hairs black on disc, mixed with a few reddish hairs in front of the scutellum and near the wings. Marginal hairs black, mixed with red which are particularly prominent above the wing root, especially in the female. Post-alar tuft with some creamy hairs; post-mesopleural prominence brown, with bright brown hairs; post-mesopleural tuft white. Scutellum deep brown; infra-scutellar tuft reddish, varying to dull gold in a few males. Legs uniformly brown. Wings smoky, with a faint yellowish tint, and some indefinite clearer areas; dark spots as in *P. olivei* Hardy, but fewer, smaller, and more discrete.

Abdomen brown, with obscure and indefinite markings, which can only be detected in some specimens, and take the form of slightly paler lateral bands and median patch, the distribution of the paler colour being similar to that of *P. olivei* Hardy. Hairs of

disc mainly reddish, mixed with a few black ones, giving the abdomen a general reddish appearance. Marginal hairs and fringe to the tergites bright red.

♂ hypopygium (Text-fig. 54): The distal end of the ninth tergite is distinctly concave. The distal end of the eighth sternite is produced on either side of the cleft to form a pair of short, thumb-like projections, a character which differentiates this and the remaining species of the group from *P. personatus* Walk., *P. nigripennis* Ric., and *P. olivei* Hardy. The dorsal lobe of the gonocoxite is strongly expanded to form a large, pointed hood; both lateral and medial lobes of the style are long and somewhat curved, while the intermediate lobe is very small. The distal part of the aedeagus is short and stout, and the proximal struts are elongate; the hooks are very short, stout, and strongly curved; the spines on their medial sides are prominent, while the space behind the spines is strongly expanded.

Length: 13 to 15 mm.

Distribution.—Tasmania: Cradle Mt., 3,700 ft., 17.i.1917 (Hardy, type series); Zeehan, i and ii.1924 (Hardy).

P. igniculus Hardy is a very distinctive species, which is easily separated from other members of the group by its abdominal markings and male hypopygium, and from species of other groups by the wing and scutal adornment. Its nearest ally is *P. olivei* Hardy. It is apparently also a frequenter of swamps.

PELECORHYNCHIUS ALBOLINEATUS Hardy.

Pelecorhynchus albolineatus Hardy, 1917, p. 64, 1920, p. 34, pl. ix, fig. 4; Ferguson, 1921*b*, p. 368; Enderlein, 1925, p. 262; Hardy, 1933, p. 412.

A large species; thorax with incomplete dorso-central lines, ending posteriorly at the suture; abdomen with pale and dark fasciae and a narrow median black vitta; wings spotted.

♂, ♀. Antennae black. Eyes not quite touching in male, separated by about the length of the frons in the female. Frons dark brown in male, yellowish-grey in the female, with a dark brown patch around the ocelli; frontal hairs black in the middle, yellowish-grey at the sides. Face and parafacialia creamy, the latter paler; hairs black on the face, creamy on the parafacialia. Ruff cream.

Scutum greyish-brown, marked with brownish-black and grey. There is a pair of sharply-defined, grey dorso-central lines, which expand to form a diamond-shaped area at the suture, behind which they terminate abruptly. These lines are surrounded by a broad zone of very dark tomentum, which begins in the anterior third of the presutural area and extends almost to the scutellum. The dark zone in the presutural sublateral area extends forward and laterally to the front of the thorax, while the postsutural sublateral area is irregularly marked with darker and lighter colour. Suture narrowly grey. A broad but short, pale grey, median stripe extends forward from the posterior margin for about one-third the length of the scutum. Scutal hairs black, mixed posteriorly at the margins with some creamy hairs, but there is no definite pale zone. Post-mesopleural prominence yellowish-brown, with concolorous hairs; post-mesopleural tuft creamy. Scutellum dark brown, the basal fourth grey; infra-scutellar tuft pale golden. Legs brown, unmarked. Wings grey, with irregular paler areas and dark grey spots, giving them a somewhat marbled appearance. The arrangement of the spots is as in other members of the group, but they are smaller than in *P. personatus* Walk., and rather fainter and more diffuse than in *P. olivei* Hardy.

Abdomen brownish-black, with a broad creamy-yellow fascia about the middle of each tergite, and a narrow median dark vitta, which interrupts the pale bands. The pale fasciae are situated progressively nearer the bases of the tergites proceeding posteriorly, until on the last visible tergite they are almost basal in position. Hairs black, a dull golden fringe to each segment, and alternating black and golden zones of lateral hairs.

♂ hypopygium (Text-fig. 55): The ninth tergite is longer than wide, and its distal edge is concave. The dorsal lobe of the gonocoxite ends in a rounded point; the medial lobe of the style is large; the intermediate lobe is rounded, and projects beyond the medial lobe; the lateral lobe is longer than in *P. personatus* Walk., and is somewhat

curved. The distal part of the aedeagus is longer than the proximal struts; the hooks are fairly long, and are evenly curved in their distal part, and the spines on their medial aspects point dorsally, while the space behind the spines is evenly tapering.

Length: ♂, 14 mm.; ♀, 18 mm.

Distribution.—Tasmania: Cradle Mt., 3,700 ft., 11 to 23.i.1917 (Hardy, type series); Cradle Valley, 10.i.1923 (Tonnoir).

P. albolineatus Hardy is most nearly allied to *P. eristaloides* Walk., from which it is to be distinguished by the presence of a presutural dorso-central line and by the absence of red pubescence on the abdomen. All other species of the group with similar abdominal markings have unspotted wings.

PELECORHYNCHUS ERISTALOIDES (Walker).

Silvius eristaloides Walker, 1848, p. 193.—*Dasybasis eristaloides* Walker, 1854, p. 267.—

Pelecorhynchus eristaloides (Walk.), Ricardo, 1900, p. 102, 1910, p. 405; Froggatt, 1911, p. 9; White, 1915, p. 22; Hardy, 1915, p. 60, 1916, p. 269, 1917, p. 63; Ricardo, 1917, p. 211; Hardy, 1920, p. 35; Ferguson, 1921b, p. 368; Surcouf, 1921a, p. 221, 1921b, p. 111; Enderlein, 1925, p. 262; Hardy, 1933, p. 412.

♂, ♀. Allied to *P. albolineatus*, from which it differs as follows: The pale dorso-central lines on the scutum are reduced to diamond-shaped patches at the suture; the dark brown zone surrounding the dorso-central area extends as a continuous vitta for the full length of the scutum, without lateral extensions. There is a fairly definite reddish zone above the wing root, and the infra-scutellar tuft is reddish. There is a zone of rich red hairs at the apices of the abdominal tergites, as well as some diffusely scattered red hairs which give the disc a reddish tint; the lateral hairs of the abdomen are entirely red in the male, in red patches in the female. Legs with a reddish hue. The wings have a distinctly more yellow tint anteriorly.

♂ hypopygium: As in other characters, nearest to *P. albolineatus* Hardy, but differing as follows: The ninth tergite is relatively long and narrow, and its distal edge is deeply bayed as in *P. kippisi*, nov. The dorsal lobe of the gonocoxite is much broader, and its distal end is straight. The distal part of the aedeagus is only slightly longer than the proximal struts; its sides are evenly curved, and do not show the usual abrupt change at the base of the hooks, which are not so strong as in other species; the spines on their medial aspects are vertically directed and not easily seen.

Length: 17 mm.

Distribution.—Type ♂, Australia, Children Collection (B.M. Nat. Hist.); another specimen labelled Australia (Children Coll.) in the Macleay Museum. Tasmania: South-east Tasmania (Ricardo); Strahan, ii.1924 (Hardy); Geeveston, 24.xii.1914 and 19.i.1916 (Hardy); Cradle Mt., no date; Zeehan, i.1924 (Hardy); Advent Bay, 9.xii.1922 (Tonnoir); Rinadeena Siding, Mt. Lyell Line, 11.i.1937 (Davis).

Like other Tasmanian species of the group, *P. eristaloides* Walk. is a frequenter of swamps.

PELECORHYNCHUS KIPPSI, n. sp.

A rather small species, with complete pale dorso-central lines on the scutum; pale abdominal fasciae interrupted by a median dark vitta; and unspotted, somewhat infuscated wings.

♂. Antennae dark brown. Eyes separated by half the width of the anterior ocellus. Frons dark brown, hairs black. Face and parafacials creamy-yellow; facial hairs creamy-yellow, with a black zone in the middle; parafacial hairs and ruff creamy-yellow.

Scutum brown, median area darker than the sublateral areas. Dorso-central lines greyish, continuous, becoming wider and almost confluent just in front of the scutellum. These lines are bordered medially by an indistinct dark brown line, and there is also an indistinct dark brown median line, which is continuous to the scutellum. The suture is concolorous with the sublateral areas, and the postsutural sublateral area is greyish laterally. Scutal hairs black, mixed on the supra-alar zone with a few creamy-yellow hairs. Post-alar and squamal tufts creamy-yellow. Scutellum grey, with a large median brown patch; infra-scutellar tuft bright golden. Post-mesopleural prominence dull brown, with mixed light and dark hairs; post-mesopleural tuft creamy-yellow. Legs brown,

darker on tarsi. Wings greyish, subhyaline, diffusely infuscated anteriorly, especially around r-m.

Abdomen dark brown, blackish towards apex of second visible tergite; with broad, pale greyish fasciae, interrupted by an irregular brown median vitta, which fades on the fourth visible tergite, leaving it almost entirely pale grey. Hairs of disc black, mixed with a few golden ones at the apical margins of the segments; lateral hairs bright golden, mixed with black, especially at the edges of the darker fasciae.

♂ hypopygium (Text-fig. 56): The genitalia are quite distinctive. The ninth tergite is slightly longer than broad, and its distal edge is deeply bayed. The dorsal lobe of the gonocoxite is not widened, and is irregularly transverse distally. The style has all three lobes well developed, the intermediate being evenly rounded. The aedeagus is relatively short and broad, with the hooks strongly recurved, and the space between them not divided into membranous and chitinous parts; the proximal struts are stout and of moderate length.

Length: 12 mm.

Distribution.—New South Wales: Barrington Tops, 29.xii.1934 (Kipps), a single male taken resting on grass.

This species is named in honour of Mr. E. H. Kipps, who collected the specimen, and whose help in the field has already been acknowledged. On genitalic characters it seems to be related to *P. igniculus* Hardy, but superficially it bears a much closer resemblance to *P. montanus* Hardy, from which, however, it is easily distinguished by the thoracic markings. The unique holotype male is in the Macleay Museum, University of Sydney.

PELECORHYNCHUS MONTANUS Hardy.

Pelecorhynchus eristoloides var. *montanus* Hardy, 1916, p. 269; Enderlein, 1925, p. 262.—

Pelecorhynchus montanus Hardy, 1917, p. 65, 1920, p. 34, pl. ix, fig. 2, 1933, p. 412.

A large, greyish species; thorax with black dorso-central lines, containing a pale spot; abdomen with black and pale grey fasciae, the latter interrupted by a narrow median black vitta; wings unspotted.

♂, ♀. Antennae black, brown at base. Eyes contiguous for a short distance in the male, separated by a little more than the length of the frons in the female. Frons of female grey, with a brown mark on each side of the ocellar triangle. Face and parafacialia creamy to greyish-white, the former with mixed dark and white to creamy hairs, the latter pale haired. Ruff creamy.

Scutum dark grey; with broad, rather irregular, dark brown dorso-central lines, which contain an elongate, pale grey spot at the level of the suture. These spots are the remains of the obsolescent pale dorso-central lines. In each sublateral area there is a dark brown mark extending forward from the post-alar callus for two-thirds the distance to the suture. *There is no median dark mark in front of the scutellum*. Scutal hairs black; supra-alar and post-alar tufts creamy. Scutellum grey, with the margins broadly dark brown and a dark brown median vitta; infra-scutellar tuft bright pale golden. Post-mesopleural prominence brown, with brown hairs, post-mesopleural tuft creamy. Legs uniformly bright brown. Wings greyish, a little darker along the veins.

Abdomen brownish-black; with broad, pale grey fasciae, that on the second visible tergite being near the middle of the segment, while the others are more nearly basal. A narrow, but conspicuous, median brownish vitta interrupts the grey fasciae. Hairs of disc mixed creamy and black, a pale yellow fringe to the apices of the tergites, and alternating pale yellow and black zones at the lateral margins.

♂ hypopygium (Text-fig. 57): The ninth tergite is slightly longer than broad, and is moderately bayed distally. The dorsal lobe of the gonocoxite is normal; the style is not unlike that of *P. igniculus* Hardy, but the medial and lateral lobes are smaller, and the intermediate lobe is larger, though not projecting as far as the base of the medial lobe. Aedeagus longer distally than proximally; hooks short, stout, and strongly curved; the spines on their medial aspects hardly visible, and the space between the spines not expanded.

Length: 16 mm.

Distribution.—Tasmania: Mt. Wellington, 4,000 ft., 6 and 10.i.1916 (Hardy, type series), also i.1924 (Hardy); Cradle Valley, 22.i.1923 (Tonnoir).

P. montanus Hardy can be distinguished from *P. kippsi*, nov. by its larger size and reduction of the pale dorso-central lines to a pair of spots, and from *P. occidentis* Hardy by the absence of a dark median patch in front of the scutellum. Other species of the group with unspotted wings have very different thoracic markings. Hardy considered that it was restricted to Mt. Wellington, but the pair collected by Mr. Tonnoir at Cradle Valley are undoubtedly this species, as was confirmed by examination of the genitalia.

PELECORHYNCHUS OCCIDENS Hardy.

Pelecorhynchus montanus var. A. Hardy, 1917, p. 65, 1920, p. 34, pl. ix, fig. 3; Ferguson, 1921b, p. 368.—*Pelecorhynchus occidentis* Hardy, 1933, p. 414.

♂, ♀. Superficially almost identical with *P. montanus* Hardy, being only distinguished by the presence of a median, triangular, brownish-black mark on the scutum immediately in front of the scutellum, and by the reduction of the dark colour on the post-sutural sublateral area. Also the pale abdominal fasciae tend to be wider. The male hypopygium (Text-fig. 58) is, however, quite different, and sets the specific distinctness of this form beyond any question. The ninth tergite and eighth sternite are longer and narrower. The aedeagus is markedly elongate distally, and has more evenly contoured sides; the hooks are long and stout, heavily chitinized, and strongly bent distally, so that their apices look proximally and slightly laterally; no spine is visible, and the space between the hooks is narrow.

Length: 16 to 18 mm.

Distribution.—Tasmania: Cradle Mt., 3,700 ft., 11.i.1917 (Hardy, type series); Cradle Valley, 22 and 26.i.1923 (Tonnoir); Zeehan, i and ii.1924 (Hardy).

Hardy (1933) notes that *P. occidentis* Hardy inhabits the fringes of large swamps, and is taken on or flying over the foliage of the larger shrubs, whereas other species occurring in the same areas are distributed over the swamps.

PELECORHYNCHUS RUBIDUS, n. sp. Pl. i, fig. 3.

A robust, reddish species. Scutum brownish-olive, with narrow pale dorso-central lines, and narrow dark lines, which are vestigial in some specimens; abdomen with reddish and black fasciae, and an inconstant median black vitta; wings unspotted.

♂, ♀. *Typical form*: Antennae bright brown, darkening towards tip. Eyes contiguous in male, separated by about half the length of the frons in the female. Frons of female brown, with an extensive dark brown mark on each side, hairs black. Face fawn, with black hairs mixed with some creamy ones; parafacials creamy-yellow, with pale yellow hairs. Ruff pale yellow.

Scutum brownish or greyish-olive, with narrow, inconspicuous, pale dorso-central lines, which commence in the posterior half of the presutural area, widen at the suture, and gradually become more indefinite towards the scutellum. A narrow, dark brown line borders each side of the dorso-central lines, that on the medial aspect being complete, while the one on the lateral aspect is shorter; there is also a narrow, median, dark, longitudinal line of variable extent. Suture grey, fairly well defined, partly bordered with dark brown. Hairs on disc black, mixed at margins with orange-yellow; supra-alar zone red, prominent; post-alar tuft bright pale yellow. Scutellum greyish-olive, brownish towards base; infra-scutellar tuft red to red-gold. Post-mesopleural prominence dark fawn, with orange-brown hairs; post-mesopleural tuft bright yellow to creamy; squamal tuft bright orange-yellow. Legs uniformly bright chestnut-brown. Wings unspotted, lightly and evenly infuscated; veins brownish-orange, giving the wings a faintly flavid appearance. There is no trace of darkening at the apices of the basal cells.

Abdomen with broad, alternating, black and pale brown to reddish-orange fasciae, and a median black vitta interrupting the pale bands; the black fasciae are not sharply indented in the middle. Hairs of disc black on the dark parts, reddish on the paler areas, giving the latter a distinctly reddish tint; apices of tergites with a red-gold fringe; margins with red-gold hairs, interrupted by small and often indefinite patches of black hairs. Venter light grey, with a narrow but conspicuous fringe of red-gold hairs at the apices of the sternites.

♂ hypopygium (Text-fig. 59): Ninth tergite distinctly longer than broad, its distal edge deeply excavated to form a bay; eighth sternite with prominent, thumb-like

processes distally on each side of the median cleft. The remarkable feature of this species is the form of the aedeagus, which is very short and broad, with the hooks turned almost straight back so as to lie along its lateral aspect, a condition not seen in any other Australian species and only approached by the Chilean *P. biguttatus* Phil.; the space between the hooks is narrow, parallel-sided, and bears no spine.

Length: 16 to 18 mm.

P. RUBIDUS VAR. *AVITTATUS*, n. var.

Southern specimens differ from the typical form in the more or less complete disappearance of dark lines on the scutum, in the rich crimson colouration of the supra-alar zone, post-scutellar tuft, marginal hairs of abdomen, and fringes at the apices of the abdominal tergites and sternites, and in the more or less complete disappearance of the black median abdominal vitta. The male genitalia differ only in that the intermediate lobe of the style is narrower and projects more in the southern form. We would regard this as a distinct subspecies, but for the fact that some southern specimens vary towards the typical form, and one female from the Blue Mts. is almost indistinguishable from the Alpine Creek specimens.

Distribution.—New South Wales: Wentworth Falls, 11.xii.1931 (Taylor); Medlow Bath, 25.i.1923 (Goldfinch); Boddington, i.1926; Blackheath, 1.ii.1926 (Nicholson & Mackerras); Blue Mts., i.1922 (Deuquet); Kuring-gai Chase, i.1926 (Nicholson); Alpine Ck., near Kiandra, 1.i.1934 (Mackerras), 26.i.1935 (Campbell), 9.i.1938 (Mackerras); Yaouk, 3,500 ft. (Taylor). A.C.T.: Blundell's, 19.i.1935 (Fuller), 22.i.1935 (Tonnoir).

P. rubidus, nov. is to be separated from all other species by its decidedly bright reddish appearance, especially when alive. Some specimens of *P. simplex*, nov. may be confused with it, but that species is typically of a fawn colour and differs in genitalia and other characters listed below. *P. rubidus*, nov. was abundant at Blackheath. The females were feeding on the flowers of a small species of *Leptospermum* growing on steep swampy ground, which descended abruptly to a small creek. The males were taken feeding on the flowers, or, more often, hovering in the air above the bushes. Occasionally females were also seen hovering, and very rarely a specimen was seen in the lower part of the swamp away from the flowers. Southern specimens were captured feeding on the flowers of a much larger species of *Leptospermum*.

The holotype male and allotype female of the typical form, from Blackheath, 1.ii.1926, and the var. *avittatus*, from Alpine Ck., 9.i.1938, have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS SIMPLEX, n. sp.

A greyish-fawn species. Scutum with narrow, dark brown dorso-central lines, interrupted at the suture; wings with an indistinct darker patch at the apices of the basal cells; abdomen without dark median vitta, and with the dark fasciae indented at the middle.

♂, ♀. Antennae reddish-brown, base of third segment paler, basal segments and tip of third darker. Eyes contiguous in male, separated in female by about two-thirds of the frons length. Frons of female dull fawn, with black hairs. Face light fawn, with mainly black hairs; parafacials paler, with creamy hairs. Ruff cream.

Scutum olive-brown, with very dark brown dorso-central lines, which are widely interrupted at the suture. Hairs of disc dark, mixed at margins with fawn; supra-alar zone dull red, with paler reflections. Scutellum olive-brown, with black hairs; infra-scutellar tuft dull orange-red, with paler reflections. Post-mesopleural prominence fawn, with light fawn hairs; post-mesopleural tuft white; squamal tuft creamy-yellow. Legs bright brown, but lacking the chestnut hue of *P. rubidus*, nov. Wings lightly infuscated, veins lacking the flavid tint of *P. rubidus*, nov. There is a somewhat indefinite but easily seen darker patch extending backwards from the bifurcation of Rs and covering the distal ends of both basal cells.

Abdomen with fawn to greyish pale fasciae and narrower brownish-black fasciae which are deeply indented at the middle. There is no black median vitta, but the ground colour in this position is of a different shade from the rest, so that the position occupied by the vitta in other species is clearly defined. Hairs on the disc black on the darker

fasciae and median area, orange on the pale fasciae; marginal hairs mixed black and orange, sometimes with a reddish hue; fringe at apices of tergites orange to orange-red. Venter pale grey; fringe to sternites creamy-yellow and inconspicuous.

♂ hypopygium (Text-fig. 60): The ninth tergite is short and broad, otherwise it and the eighth sternite are similar to *P. rubidus*, nov. The gonocoxite is normal, its dorsal lobe fairly narrow. The style has a relatively large intermediate lobe. The distal part of the aedeagus is slightly longer than its basal struts; the hooks are heavily chitinated, strongly upturned, and somewhat laterally directed at the tip; they resemble most those of *P. occidens* Hardy, but are shorter and stouter; the strong chitination forms a zone marking the hooks off completely from the basal part of the aedeagus.

Length: 15 to 16 mm.

A male and female from Mt. Kosciusko lack the dark dorso-central lines, and the dark mark on the wing is very faint. In many respects they are intermediate between *P. simplex*, nov. and *P. rubidus*, nov., but their general facies is not reddish and the genitalia of the male are the same as in *P. simplex*, nov.

Distribution.—New South Wales: Alpine Creek, near Kiandra, 2.i.1932 (Willings), 22.xii.1933 (Mackerras); Rules Point, near Kiandra, 23.xii.1933 (Mackerras); Mt. Kosciusko, 27.xii.1924 (Goldfinch).

P. simplex, nov. is typically quite distinct from *P. rubidus*, nov., but both are variable, and some females may be difficult to allot with certainty. The general fawn colour, indentation of the dark abdominal fasciae, and the absence of a conspicuous reddish fringe to the abdominal sternites should be adequate diagnostic characters. The male genitalia are entirely different. This species has been taken on low shrubs and herbage in small swamps.

The holotype male, from Alpine Creek (Willings) and the allotype female, from Rules Point, have been placed in the Macleay Museum, University of Sydney.

PELECORHYNCHUS SIMPLISSIMUS, n. sp.

A rather long-bodied, dark fawn species, with a small head and relatively indefinite abdominal fasciae.

♀. Antennae reddish-brown. Eyes separated by about the length of the frons, which is dull fawnish-brown, with black hairs. Face slightly darker, with mixed black and cream hairs; parafacials rather paler, with cream hairs. Ruff dull cream.

Scutum dull brownish-fawn, with complete grey dorso-central lines, which widen and become indefinite in front of the scutellum; there is a rather indefinite, discontinuous, darker line bordering the dorso-central lines medially in the presutural and postsutural areas. Hairs of disc mainly black, with a small admixture of gold in the supra-alar zone and a definite pale cream post-alar tuft. Scutellum greyish-fawn; infra-scutellar tuft bright gold. Post-mesopleural prominence dark fawn, with yellowish-fawn hairs; post-mesopleural tuft pale cream; squamal tuft almost white. Legs light orange-brown. Wings lightly infuscated; all veins orange, giving the wing a rather flavid appearance like that of *P. rubidus*, nov.

Abdomen dull greyish-fawn, with brown fasciae which fade into the paler colour, and an indefinite brownish median vitta. Hairs of disc mainly black; lateral margins with a zone of pale golden hairs. Venter pale grey tinged with fawn; apices of the sternites with mixed black and pale gold hairs, which do not form a distinct fringe.

Length: 15 mm.

Distribution.—New South Wales: Barrington Tops, 13.xii.1921 (Goldfinch).

The narrow head and relatively long body of this species are reminiscent of some of the primitive Stratiomyiidae. It is probably most nearly related to *P. simplex*, nov., but is distinguished by its general dull colouration, inconspicuous markings, and complete absence of reddish hairs.

The unique holotype female has been lodged in the Macleay Museum, University of Sydney.

The *fulvus* group.

PELECORHYNCHUS FULVUS Ricardo. Pl. i. fig. 5.

Pelecorhynchus fulvus Ricardo, 1910, p. 406; Taylor, 1919, p. 41; Hardy, 1920, p. 38; Ferguson, 1921a, p. 2; Hardy, 1922, p. 196, pl. xxxvi, fig. 3; Surcouf, 1921a, p. 221,

1921*b*, p. 111; Tillyard, 1926, p. 359, pl. xx, fig. 20; Enderlein, 1925, p. 262; Hardy, 1940, p. 486.

A medium-sized, relatively narrow-bodied, predominantly orange, dimorphic species. Median area of thorax orange, sublateral areas black. Wings orange, infuscated apically with black; legs black, with yellow tarsi. Abdomen of ♂ black; of ♀ orange, with black vittae.

♂. Antennae black. Eyes separated by the length of the frons, a most unusual character. Frons and face shining black, with some hoary tomentum and black hairs; parafacials creamy, with white hairs. Ruff greyish, rather sparse.

Scutum with sublateral areas black, with black hairs; median area bright orange, with golden hairs; dorso-central lines continuous, pale yellow, bordered laterally by a narrow orange zone. There is a short black line on each side of the mid-line anteriorly, and a similar pair of lines posteriorly, the latter often being confluent in front of the scutellum, which is dull yellow in colour, and has a broad median and narrower lateral black stripes. Marginal hairs of scutum black, mixed with silvery-white; supra-alar zone and post-alar tuft silvery-white; infra-scutellar tuft black in its middle third, silvery-white laterally. Pleurae black, with mixed black and grey hairs on the post-mesopleural prominence, and silvery-white post-mesopleural and squamal tufts. Legs black, with bright yellow tarsi. Wings orange, suffused with black apically and anteriorly beyond the bifurcation of Rs, with the exception of the greater part of cell R₅, which is pale yellowish and appears almost white by contrast with the rest of the wing. Similar but less definite pale areas occur in the distal cells bounded by the branches of M.

Abdomen shining black, with a pair of indefinite paler areas and zones of white hairs on the basal visible tergite. Hairs of disc black; marginal hairs white, except towards the apices, where they are more or less replaced by black.

♂ hypopygium (Text-fig. 61): The ninth tergite is broader than long, with its distal edge gently concave; the ninth sternite is large, and without thumb-like projections distally. The dorsal lobe of the gonocoxite is greatly expanded, and forms a flattened shield, of which the distal edge is straight and at right angles to the medial edge. The lateral lobe of the style is long and bluntly pointed, the medial lobe is shorter, broader, and rounded distally, while the intermediate lobe is very small and rounded. The aedeagus is of normal width, but the hooks are more acuminate than in other groups and but slightly upturned, while the space between them is linear. The ninth sternite is exceptional, in that it projects distally as a prominent, rounded, median lobe, a character which is shared with *P. mirabilis* Tayl.

Length: 12 mm.

♀. Differs from the ♂ in its larger size, in having some brown tomentum on the frons and face, in the slightly greater separation of the eyes, in the richer colour of the median area of the scutum, in the less prominent black cloud in the distal part of the wing, and especially in the abdominal markings. The dorsum is covered with rich orange tomentum, with conspicuous black side margins and a black median vitta, which fades on the fourth visible tergite; the venter is shining black as in the male.

Length: 14 to 15 mm.

Distribution.—Victoria: Type ♀, Victorian Alps; type ♂, Bright (H. W. Davey). New South Wales: Uralla, no date; Capertee, no date (Armstrong and Carter); Mt. Bindo, nr. Hampton, 4,100 ft., no date (Tillyard); Blue Mts., i.1922 (Deuquet); Wentworth Falls, 14.xii.1924 (Harrison), 11.xii.1931 (Taylor); Mittagong, 26.xi.1904 (Froggatt), 13 and 16.xi.1924 (Goldfinch); Sutherland, nr. Sydney, no date; Tinderry Range, 1.i.1938 (Kipps); Queanbeyan R., nr. Mt. Tinderry, 2.i.1938 (Mackerras); Sawpit Ck., Mt. Kosciusko, 4,000 ft., 11.xii.1931 (Tillyard); Diggers Ck., Mt. Kosciusko, 5,000 ft., 23.i.1929 (Tillyard). A.C.T.: Blundell's, 28.xi.1930 (Graham).

This very distinct species is easily recognized by its thoracic and wing markings. It has been taken feeding on flowers of *Leptospermum* spp. It is difficult to see, as it frequents the tops of higher bushes, its movements being relatively sluggish. It bears when alive a really extraordinary resemblance to some of the common orange-coloured beetles, and certainly forms a member of that association which has been referred to by Nicholson (1927) as the *Metriorhynchus* complex.

PELECORHYNCHUS MIRABILIS Taylor.

Pelecorhynchus mirabilis Taylor, 1917, p. 513; Hardy, 1920, p. 36; Enderlein, 1925, p. 262; Hardy, 1940, p. 486.

A very small, dimorphic species. Thorax brown to black, with complete pale dorso-central lines; legs dark, with yellow knees and tarsi. Wings spotted. Abdomen of ♂ black, with grey maculae; of ♀ orange, with black vittae.

♂. Antennae with basal segment black, second creamy-yellow, third orange, darkened at the tip. Eyes separated by about two-thirds of the length of the frons. Frons greyish, with a brown patch on either side around the antennae, and a black mark in the mid-line above the antennae; hairs black. Face with brown and grey tomentum and black hairs; parafacials greyish-white, with fine white hairs; ruff white.

Scutum brown, with complete, prominent, grey dorso-central lines and extensive brownish-black markings. The median area is almost entirely blackish, except for a narrow zone on each side, and a median brown vitta, which is broadest anteriorly, and tapers to a point in the posterior third of the scutum. The sublateral areas contain large, elongate, brownish-black patches. Hairs of disc black, mixed at margins with white hairs; supra-alar zone and post-alar tuft white. Scutellum black in centre, greyish-yellow laterally; infra-scutellar tuft black in centre, white laterally. Post-mesopleural prominence black, with dark hairs; tufts on pleurae greyish-white, except the post-spiracular tuft, which is pure white. Legs with the femora and hind tibiae black; fore and mid tibiae brown, paler ventrally; knees and tarsi of all legs bright yellow. Wings smoky, tinged with yellow anteriorly. There are several greyish-brown patches, which are sometimes rather indefinite. One extends irregularly backwards from the bifurcation of R_s to Cu_1 , a second surrounds the distal end of the discal cell, and a third covers the bifurcation of R_{4+5} , while the apical part of the radial field distal to the tip of R_1 is diffusely clouded.

Abdomen covered with dark brown, almost black tomentum; first four visible tergites with paired, yellowish-grey, semilunar patches. Hairs of disc predominantly black; apical fringe of the tergites partly pale gold; marginal zone of hairs white. Venter bare, shining, black.

♂ hypopygium (Text-fig. 62): The genitalia are unusually large and prominent relative to the size of the insect. The ninth tergite is bulbous, as wide as long, but somewhat narrower distally; its distal edge is incised laterally and broadly lobed in the middle. The eighth sternite is large, and is remarkable in that its distal edge is transverse, while there is a short process on each side of the very shallow cleft. The clasping organs are generally similar to those of *P. fulvus* Ric., but the medial lobe of the style is much longer and more slender, while the intermediate lobe is markedly larger. The aedeagus is extraordinarily broadened, but is of the *fulvus* type, and the distal bulging of the ninth sternite is equally well marked.

Length: 10 to 11 mm.

♀. Larger than the ♂. Eyes separated by about the length of the frons. Frons and parafacials more yellowish. The blackish markings on the scutum are less extensive, particularly in the sublateral areas, which gives the ground colour of the thorax a more brownish appearance; dorso-central lines more yellowish. Legs paler than in the male. Abdomen rich orange, with black side margins and a median black vitta, which is interrupted at the posterior margin of each tergite and disappears on the fourth visible tergite.

Length: 12 to 13 mm.

Distribution.—Queensland: Types from Stradbroke I. and Brisbane; specimens from Stradbroke I. are dated vii and ix.1891, 2.x.1911, 17.ix.1915; and ix.1926 (Mackerras). New South Wales: Richmond R., x.1922 (Burns).

P. mirabilis Tayl. is the smallest and one of the most distinct of the known species. The wing markings and the abdomen of the male suggest an affinity with the *personatus* group, but all other characters indicate relationship with *P. fulvus* Ric. It was fairly common near Dunwich, on Stradbroke I., in September. The females were taken feeding on the flowers of *Leptospermum flavesceus*, on which, like *P. fulvus* Ric., they usually selected the tops of the bushes, and were consequently difficult to capture. The males

also frequented the flowers, but lay hidden in the bush and were rarely seen, although a good many were captured by sweeping over the bushes.

PELECORHYNCHUS DISTINCTUS Taylor.

Pelecorhynchus distinctus Taylor, 1918, p. 53; Hardy, 1920, p. 38, pl. ix, fig. 5; Surcouf, 1921a, p. 221; Enderlein, 1925, p. 262; Hardy, 1940, p. 486.

A large, ornate, dimorphic species. Thorax black, with yellow dorso-central lines. Wings yellowish, with two black patches. Legs black or bright brown, and yellow. Abdomen shining black in ♂; orange, with a median black vitta in ♀.

♂. Antennae bright orange, basal segments black. Eyes closely approximated, but not quite touching. Frons with dull yellow tomentum and black hairs. Face with yellowish tomentum; there is a large, bare, shining patch on each side, between which is a narrow, dark brown, median line, and below which is a large median patch of dark brown tomentum; hairs dark. Parafacials creamy, with white hairs. Ruff white.

Scutum velvety black, with conspicuous, broad, complete, yellow dorso-central lines, which are paler towards their centres; there is a zone of yellowish tomentum at each lateral margin; marginal hairs all black. Scutellum black in centre, yellow at margins, corresponding to the markings of the median area of the scutum; infra-scutellar tuft black in centre, white laterally. Pleurae black; post-mesopleural prominence with dark brown hairs; post-mesopleural and squamal tufts white. Legs with all femora and hind tibiae black to deep brown; fore and mid tibiae and all tarsi yellow. Wings rich orange anteriorly, more greyish-yellow posteriorly, with a smoky zone along the posterior border. There are two large, dark brown patches; one extends from near the base of the wing to a point a little distal to r-m, involving both basal cells almost completely and a portion of cell Cu_2 ; the second occupies the entire radial field from the apex of R_1 to a point a little distal to the bifurcation of R_{4+5} .

Abdomen shining black, dorsally and ventrally; hairs at base and along sides of second and third visible tergites white, also a white patch at base ventrally, remainder black.

♂ hypopygium: These structures have been illustrated in detail (Text-figs. 18-23). The ninth tergite and eighth sternite are short and broad, and the distal edge of the former is evenly concave. The dorsal lobe of the gonocoxite is expanded to form a large hood, as in the other members of the group; the style is like that of *P. fulvus* Ric., except that the lateral lobe is straighter and more pointed, and the intermediate lobe is rather larger and underlies the medial lobe. The aedeagus and the evenly concave distal edge of the ninth sternite are of the type normal to the genus, and the hooks of the former are markedly upcurved.

Length: 14 mm.

♀. Larger than the ♂. The frons is slightly wider than long, and is tinged with orange on either side of the mid-line; the markings of the face are rich brown, and the facial hairs are short and relatively sparse. All femora and the hind tibiae are bright brown, but the remaining segments are similar to the ♂. The dorsum of the abdomen is covered with bright orange tomentum, except the margins, which are bare and of a bright brown colour; there is a broad, complete median, black to deep chocolate brown vitta, which is wider than in the allied species; venter bare, shining, brown.

Length: 15 to 16 mm.

Distribution.—New South Wales: Dorrigo, no date (holotype ♀); Barrington Tops, 7.ii.1925 (S.U. Zool. Exped.), numerous specimens of both sexes.

P. distinctus Tayl. is a very handsome species, which cannot be confused with any other. It is most nearly related to *P. fulvus* Ric., but it is less specialized, particularly in the characters of the aedeagus. It was abundant at Barrington Tops, where females were taken feeding on the flowers of *Leptospermum* sp., while the males were captured either feeding or hovering over the flower patch. It is exceedingly active and wary, and when alive has a decidedly wasp-like appearance.

As the male has not been described previously, the allotype has been selected from the Barrington Tops series and lodged in the Macleay Museum, University of Sydney.

The *fusconiger* group.

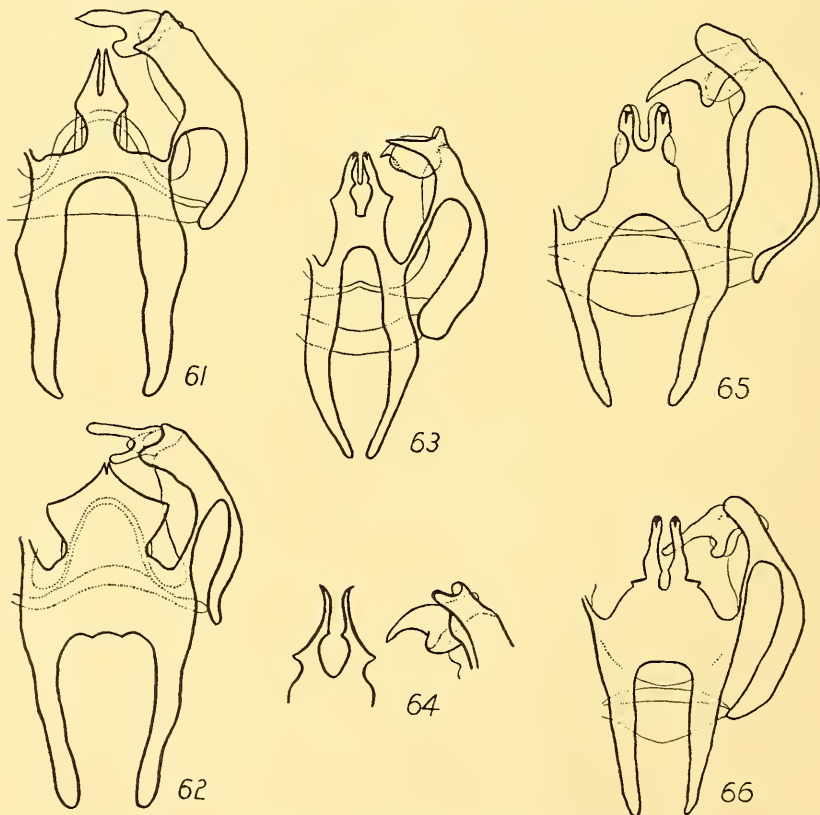
PELECORHYNCHUS FUSCONIGER (Walker). Pl. i, fig. 6.

Silvius? fusconiger Walker, 1848, p. 192.—*Dasybasis fusconiger* Walker, 1854, p. 267.—*Pelecorhynchus fusconiger* (Walk.), Ricardo, 1900, p. 102, 1910, p. 407; Froggatt, 1911, p. 9; Hardy, 1915, p. 60, 1916, p. 270, 1917, p. 63; Taylor, 1917, p. 513, 1918, p. 55; Hardy, 1920, p. 37; Ferguson, 1921a, p. 2, 1921b, p. 368; Surcouf, 1921a, p. 221, 1921b, p. 111; Enderlein, 1925, p. 262; Hardy, 1933, p. 412.

A stout-bodied, dull coloured species, with brown scutum, black abdomen, lightly infuscated yellowish-grey wings, and devoid of red hairs on any part of the body except occasionally the supra-alar zone. Includes three subspecies and a variety.

♂, ♀. *Typical form*: Basal segments of antennae dark brown, third segment tawny, darkening to black at the tip. Eyes contiguous in male, separated in female by about half the length of the frons. Frons with velvety, brown tomentum and short, sparse black hairs; face with olive-brown tomentum and black hairs, which are sometimes mixed with some creamy ones; parafacials olive-brown, with fine creamy-yellow hairs. Ruff creamy at base, yellowish on distal half.

Scutum nearly as broad as long, covered with velvety brown tomentum, which pales in the mid-line to form a narrow, very inconspicuous vitta, and darkens at the dorso-central lines to give them an indefinite border. The dorso-central lines are dull grey, inconspicuous, and widen out at and disappear behind the suture, which is also grey; this wider part is paler than the rest of the line, and may form a fairly obvious spot. Scutal hairs black; margins with denser, longer, black hairs mixed with creamy ones; supra-alar zone orange-yellow, with brown base. Infra-scutellar tuft black to dark grey in the centre, with a variable amount of creamy-yellow at the sides. Post-mesopleural



Text-figs. 61-62.—Male hypopygia of *fulvus* group. 61. *P. fulvus* Ric. 62. *P. mirabilis* Tayl.

Text-figs. 63-66.—Male hypopygia of *fusconiger* group. 63. *P. fusconiger* Walk. 64. *P. lineatus*, n. sp. (distal parts only). 65. *P. fascipennis*, n. sp. 66. *P. tillyardi* Tayl.

prominence with dull yellowish-brown hairs mixed with black; post-mesopleural tuft creamy at base, becoming dull yellowish on distal half; squamal tuft white. Femora of fore and mid legs black, remaining segments brown; hind legs entirely black. Wings grey; veins orange-yellow, giving the wing a yellowish tint, especially anteriorly.

Abdomen shining black, the tergites with black hairs; the fourth and fifth visible tergites bear in addition a considerable number of pale hairs, which in the male are very conspicuous in certain lights. Lateral margins with dense black hairs, which are interrupted at the edges of the second and third visible segments by narrow zones of white, and at the edge of the fourth visible segment by a broader, more creamy zone.

♂ hypopygium (Text-fig. 63): Members of the series, of which this species is the type, resemble each other in the following points: the ninth tergite is not deeply excavated distally, and the distal edge of the eighth sternite is not produced into a pair of thumb-like processes; the dorsal lobe of the gonocoxite is produced to form a strong, pointed, spine-like process; the style resembles a parrot's beak, the lateral lobe being short, curved, and pointed, and the medial lobe large and rounded, while the intermediate lobe is partly amalgamated with the medial; the aedeagus bears stout, strongly curved hooks, the spine on their medial side is well developed, and the space basal to the spines is expanded. In *P. fusconiger* Walk. the ninth tergite is distinctly longer than wide, the lateral lobe of the style is very short and the medial is large and rounded, and the hooks of the aedeagus are moderately stout. The genitalia of the subspecies and variety described below are similar, but there is some variation in the relative development of the lobes of the style and in the strength and curvature of the hooks of the aedeagus.

Length: 16 to 18 mm.

Three subspecies and a variety are recognized, as they show differences which, though not of specific value, are constant over large series of specimens.

P. FUSCONIGER FUSCONIGER (Walk.).

This is the typical form described above. Its special characteristics are: the brown antennae, the narrow frons of the female, black hairs on the face, very inconspicuous scutal markings, creamy or dull yellow ruff and hair tufts, brown fore and mid tibiae and tarsi, and rather flavid tint of the anterior part of the wing.

Distribution.—New South Wales: Between Sydney, N.S.W., and Moreton Bay, Qd. (Ricardo), type locality; Port Stephens (Froggatt); Barrington Tops, 7.ii.1925 (S.U. Zool. Exped.); La Perouse, Sydney, 12 and 19.x.1919 (Hardy); Killara, Sydney, 27.x.1934 (D. F. Waterhouse); Woodford, 7 to 30.xi.1925 and 1926 (Nicholson and Mackerras); Wentworth Falls, 11.xii.1926 (Mackerras), 11.xii.1931 (Taylor); Blackheath, 12 to 24.xi.1919 (Hardy), and 24.xii.1921 (Ferguson).

P. FUSCONIGER var. *RUFIBASIS*, n. var.

Differs from all others in having a rich, orange-red supra-alar tuft. In most other respects it resembles the typical form, but approaches the *alpinensis* subspecies in the relatively wide frons.

Distribution.—New South Wales: Yarrangobilly, 28.i.1935 (Fuller); Ulladulla, no date (Taylor). A.C.T.: Blundell's, 19.i.1935 (Fuller), 22.i.1935 (Rafferty), 25.xii.1937 (Kipps). Victoria: Mt. Buffalo (noted by Ferguson, 1921, and almost certainly referable here).

P. FUSCONIGER ALPINENSIS, n. subsp.

Antennae black; frons of female almost as wide as long; the face with pale yellowish-fawn hairs, without admixture of black hairs; the scutum has a dark median line, the dark borders to the dorso-central lines are more conspicuous than in the typical form, and the hairs of the lateral margins are almost entirely dull orange-yellow. The legs are entirely black, and the wing is more greyish, almost completely lacking the flavid tint. The pale abdominal hairs are duller in colour and less conspicuous than in the typical form.

Distribution.—New South Wales: Mt. Tinderry, 1.i.1938 (Kipps); Alpine Ck., near Kiandra, 2.i.1932 (Willings), 22.xii.1933 and 1.i.1934 (Mackerras), 26.i.1935 (Fuller and Campbell), 24.xii.1935 (Fuller), 8.i.1938 (Mackerras); Rules Point, 23.xii.1933

(Mackerras); Yarrangobilly, 28.i.1935 (Fuller); Mt. Kosciusko, 4,500 ft., 31.xii.1933 (Mackerras). Tasmania: Ulverstone (Lea); Burnie (Ferguson); Wynyard, 21.i.1915 (Hardy). (Note: We have not seen the Tasmanian specimens recently, and cannot be positive that they are correctly placed in this subspecies, but we believe that they are.)

P. FUSCONIGER FERGUSONI Hardy.

Pelecorhynchus fergusonii Hardy, 1939, p. 41.

Less stoutly built and slightly smaller than the other subspecies. Ruff, post-mesopleural tuft and hairs at sides of scutum bright canary-yellow, rather than creamy or dull yellow. Scutum dark slaty-grey, with darker, brownish patches; dorso-central lines relatively conspicuous, grey bordered with brown; scutellum uniformly dark slaty-grey. Pale hairs at sides of abdomen continuous rather than in patches. Antennae, frons of female, face, legs, and wings as in typical subspecies.

Distribution.—Queensland: Stradbroke I., 2.x.1911 (Hacker), 17.ix.1915 (Hacker), ix.1926 (Mackerras); Sunnybank, near Brisbane, ix.1926 and ix.1927 (Hardy). New South Wales: Ballina, 6.x.1922 (Ferguson).

P. fusconiger Walk. is the most abundant and widely distributed, and at the same time the least distinctive of the Australian species. It is to be separated from its allies by the complete absence of red hairs in the ruff, the pleural tufts, and the abdomen. In the warmer and more low-lying parts of its range it is on the wing in the spring, but appears later as the climate becomes cooler, until, in Tasmania and on the mountain tops, it is a characteristic midsummer species. Females are usually captured feeding on the flowers of *Leptospermum* spp. They do not appear to be so restricted in feeding habits as some of the other species, but visit almost any species of *Leptospermum* that is in bloom at the time they are active. They move rather sluggishly on the flowers, but are very quick to take flight if disturbed. Males may be taken feeding, but are seen more frequently hovering over sunny patches of grass or rock, or over damp situations where there is considerable soakage. When hovering in the sun, the pale hairs of the abdomen are very conspicuous, often giving the appearance of a brilliant white or creamy fascia. When there is much wind or the day is dull, occasional specimens may be taken sheltering under ledges of rock or resting on low foliage.

The types of the new subspecies and variety have been lodged in the Macleay Museum, University of Sydney, the selected specimens being: var. *rufibasis*, holotype ♂, Yarrangobilly, 28.i.1925, allotype ♀, Blundell's, 19.i.1935; subsp. *alpinensis*, holotype ♀ and allotype ♀, Alpine Creek, 8.i.1938.

PELECORHYNCHUS NERO, n. sp.

An obscure species, with brown thorax, black abdomen, and yellow-tinged wings. The ruff and post-mesopleural tuft are reddish, and the abdomen bears small lateral patches of white hair.

♂, ♀. Antennae deep brown, darkening at the tip. Eyes contiguous in the male, separated by about half the frons length in the female. Frons and face with brown tomentum; frons with very short black hairs, face with long black and red to russet hairs. Parafacials creamy, with pale reddish hair. Ruff a rusty red.

Scutum with brown tomentum; dorso-central lines fairly prominent, light brown bordered laterally by dark brown, greyish at the sutural spot, and extending posteriorly nearly to the scutellum. Scutal hairs black, mixed with brown anteriorly and with red posteriorly; margins with red hairs, densest above the wing root, and mixed with some black hairs anteriorly. Scutellum brown; infra-scutellar tuft black in centre, red at sides. Hairs of post-mesopleural prominence russet, mixed with some black; post-mesopleural tuft rusty red. Legs black, fore tibiae and tarsi with a brownish tint. Wings evenly infuscated with greyish-brown, with a slight yellowish tinge anteriorly.

Abdomen shining black, with black hairs on most of the disc and some white ones posteriorly; lateral margins with dense black hairs, two small patches of white, and some white hairs at the side of the fourth visible segment. Hypopygium of male identical with that of *P. fusconiger* Walk.

Length: 15 to 16 mm.

Distribution.—New South Wales: Barrington Tops, 7.ii.1925 (S.U. Zool. Exped.).

P. nero, nov. combines in a curious fashion a number of the characteristics of other species of the series. Its abdomen is like *P. fusconiger* Walk., and the dorso-central lines approach that species rather closely; in scutal and wing ornamentation it resembles *P. claripennis* Ric., while the ruff and pleural adornment correspond to *P. nebulosus*, nov. It may be distinguished from all by the combination of red ruff and post-mesopleural tuft with white patches of hair on the abdomen and uniformly clouded wings. It was taken feeding on *Leptospermum* sp.

The holotype male and allotype female have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS CLARIPENNIS Ricardo.

Pelecorhynchus claripennis Ricardo, 1910, p. 408; Hardy, 1920, p. 37; Ferguson, 1921a, p. 2; Surcouf, 1921a, p. 221, Surcouf, 1921b, p. 111; Enderlein, 1925, p. 262.

A stout species, with brown thorax, reddish-black abdomen, and lightly infuscated wings. The ruff is yellow, post-mesopleural tuft pale cream, and the infra-scutellar tuft and lateral abdominal hairs are red.

♂, ♀. Antennae brown, darkening to black at the tip. Eyes contiguous in the male, separated by rather more than half the frons length in the female. Frons and face brown, with black hairs, on the face mixed with some russet hairs. Parafacials creamy, with russet hairs. Ruff dull yellow.

Scutum with brown tomentum, slightly lighter in the centre, and darker bordering the dorso-central lines, which are very inconspicuous, and end posteriorly in a somewhat clearer spot at the suture. Scutal hairs black, mixed with brown anteriorly and with red posteriorly; margins with black hairs, mixed with some red, which predominate and form a conspicuous patch of colour above the wing root. Scutellum brown; infra-scutellar tuft crimson. Post-mesopleural prominence with russet and black hairs; post-mesopleural tuft pale cream to white. Legs entirely brown, the hind legs somewhat darker. Wings uniformly and lightly infuscated, some specimens with a yellow tint anteriorly.

Abdomen black, the tergites with black and red hairs, which give the dorsum a reddish-black appearance to the naked eye. Lateral margins with rich red hairs, and a small patch of white at the side of the second visible segment; the red colour is particularly striking in the male. Apices of visible tergites 3 and 4 with red and black hairs.

♂ hypopygium: Differs from *P. fusconiger* Walk. in that the ninth tergite is shorter, broader, and more concave distally; also the hooks of the aedeagus are more back-turned and somewhat laterally directed at the tip, and the space between them is wider. Length: 15 mm.

Distribution.—Victoria: Dandenong Ranges, no date (type locality); Warburton, 15.xii.1918 (Ferguson). New South Wales: Woodford, 14.xi.1926 (Mackerras); Wentworth Falls, 14 and 21.xii.1923 (Nicholson), 17.xii.1921 (Ferguson), 11.xii.1931 (Taylor); Blackheath, 13.xi.1919 (Ferguson); Alpine Ck., near Kiandra, 2.i.1932 (Willings), 26.i.1935 (Campbell), 8.i.1938 (Mackerras); Mt. Kosciusko, over 6,000 ft., 20.i.1924 (Mitchell).

This species is to be distinguished from *P. fusconiger* Walk. by its red infra-scutellar and abdominal hairs, and from *P. nero*, nov. and *P. nebulosus*, nov. by the yellow ruff and creamy post-mesopleural tuft. Other differences will be found under those species. *P. claripennis* Ric. was described from Victoria, but it is not uncommon in the Blue Mts. and near Kiandra. Its habits are similar to those of *P. fusconiger* Walk., but it is much less common and appears rather later in the season.

The allotype male, this sex not having been previously described, from Wentworth Falls, 21.xii.1923, has been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS NEBULOSUS, n. sp.

Pelecorhynchus fusconiger Walker, var. Hardy, 1920, p. 37.

A dark species, with rich brown scutum, black abdomen, and wings distinctly clouded with yellow and grey; ruff russet, post-mesopleural tuft very dark, lateral abdominal hairs red.

♂, ♀. Antennae bright brown, darker towards the tip. Eyes contiguous in male, separated by rather more than half the frons length in the female. Frons and face with brown tomentum; frons with short, brown hairs, face with mixed black and russet to yellow hairs. Parafacials creamy, with golden to orange hairs. Ruff bright rufous, in some specimens orange at base.

Scutum with rich, dark brown, velvety tomentum. Dorso-central lines inconspicuous, brown bordered with black, and disappearing some distance behind the suture. Scutal hairs brown, with a strong admixture of longer, red hairs posteriorly; margins with dense, dark red and black hairs, more definitely red above the wing roots. Scutellum brown; infra-scutellar tuft black to steel-grey. Post-mesopleural prominence with black and russet hairs; post-mesopleural tuft with dark rufous and black hairs, in some specimens the rufous predominating, in others the black. Fore and mid legs brown to dark brown, the femora darker than the other segments; hind legs uniformly very deep brown to black. Wings evenly suffused with yellow, with two faint irregular smoky patches, the distal one extending from the apex of R_1 to the apex of R_5 , and the other more or less covering the basal cells. Veins orange-brown.

Abdomen black; tergites with black hair; lateral margins with rich red hair, which extends medially onto the distal edges of the segments. In some specimens the marginal hairs are largely black, and the red restricted to small patches.

♂ hypopygium: The ninth tergite resembles that of *P. fusconiger* Walk.; in all other respects it closely resembles *P. lineatus*, nov. (Text-fig. 64). The dorsal spine of the gonocoxite is relatively short, and is rounded apically; the medial lobe of the style is markedly less developed than in the preceding species of the series; and the hooks of the aedeagus are slender and not so strongly upcurved.

Length: 16 mm.

Distribution.—New South Wales: Woodford, 30.xi.1925 (Mackerras); Wentworth Falls, 17.xii.1921 (Ferguson), 14.xii.1923 (Harrison), 21.xii.1923 (Nicholson), 11.xii.1926 (Mackerras), 11.xii.1931 (Taylor); Blackheath, 13.xi.1919 (Ferguson); Blue Mts., i.1922 (Dequet).

The markings of the wings and the blackish infra-scutellar tuft will distinguish this species from its allies. In addition, the red ruff and red to black post-mesopleural tuft will separate it from *P. claripennis* Ric., and the red lateral abdominal hairs from *P. nero*, nov. So far *P. nebulosus*, nov. is only known from the Blue Mts. At Wentworth Falls it is fairly common in December, but appears to have a very short season, and may easily be missed. One very windy and somewhat bleak day at this locality, a number of specimens was seen sheltering under an overhanging ledge of rock some twelve feet above a small creek. More usually they are taken when feeding on *Leptospermum flavescens* Sm.

The holotype male and allotype female, from Wentworth Falls, 11.xii.1926, have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS LINEATUS, n. sp.

A stout, black species, with complete, conspicuous, creamy dorso-central lines. Wings strongly tinged with yellow. Tibiae and tarsi flavid.

♂, ♀. Antennae orange, darker towards the tip. Eyes contiguous in the male, separated by about half the frons length in the female. Frons with brown tomentum, in the female with two longitudinal darker brown stripes near the mid-line; hairs brown, mixed with a few black ones. Face brown; in the male with black and russet hairs, in the female with shorter, more orange hairs. Parafacials creamy, with russet to orange hairs. Ruff bright red, with a russet tint.

Scutum with rich, brownish-black tomentum. Dorso-central lines brilliant, creamy in colour, continuous almost to the scutellum, and not widened at the suture, which is inconspicuous. Scutal hairs black, mixed with reddish-brown. Marginal hairs and supra-alar zone crimson in male, more russet-red in female. Scutellum black; infra-scutellar tuft black, with a narrow patch of crimson hairs laterally. Post-mesopleural prominence brown, with orange-russet hairs; post-mesopleural tuft black at base, rich crimson distally and above in male, russet in female. Femora of all legs dark brown to

black, somewhat lighter in female; remaining segments flavid. Wings ochreous, tinged with grey posteriorly.

Abdomen shining black, with black hairs on disc and at sides. In the male there is a variable amount of red among the black hairs; it may be hardly detectable, or the posterior part of the margin may be predominantly red.

♂ hypopygium (Text-fig. 64): The ninth tergite is short and broad, and its distal edge is nearly straight. The gonocoxite and aedeagus are very like those of *P. nebulosus*, nov., but the hooks of the aedeagus are slightly shorter, the medial lobe of the style is slightly smaller, and the dorsal spine of the gonocoxite is a little shorter and blunter.

Length: 13 to 14 mm.

Distribution.—New South Wales: Blue Mts., i.1922 (Deuquet); Woodford, 17.i.1926 (Mackerras); Wentworth Falls, 11.xii.1931 (Taylor).

P. lineatus, nov. is the most distinct of the *fusciger* series by reason of its brilliant dorso-central lines. From *P. interruptus*, nov., to which it is most nearly related, it is to be distinguished by the continuous dorso-central lines, the red pubescence, and the flavid legs. The pubescence of the other males is not so richly crimson as in the holotype, but it was captured shortly after emergence, resting on grass adjacent to a small swamp, and probably represents the more normal colouration of perfectly fresh specimens.

The holotype male, from Woodford, and the allotype female, from Blue Mts. (Deuquet), have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS INTERRUPTUS, n. sp.

An entirely black species, with conspicuous, interrupted dorso-central lines.

♂, ♀. Antennae black. Eyes contiguous in male, separated by rather more than half the frons width in the female. Frons and face deep brown varying to grey, with black hair. Parafacials pale grey, with black hair. Ruff black, mixed with a variable amount of grey.

Scutum black; dorso-central lines conspicuous, grey, with a brownish tint anteriorly. These lines are continuous to the suture, where they are somewhat expanded; behind the suture they are interrupted for about half the post-sutural length, and then appear again, to expand in a pear-shaped manner in front of the scutellum. Suture inconspicuous. Scutal, marginal, supra-alar, infra-scutellar, and mesopleural pubescence entirely black; squamal tuft white. Legs entirely black, with conspicuous flavid pulvilli and empodia. Wings grey, distinctly darker on apical third, and with the basal two-thirds anteriorly suffused with bright orange.

Abdomen entirely shining black, with black hairs. Male hypopygium identical with that of *P. lineatus*, nov.

Length: 14 to 15 mm.

Distribution.—New South Wales: Barrington Tops, 7.ii.1925 (S.U. Zool. Exped.).

An easily recognizable species by its entirely black colour and pubescence, and by the conspicuous, interrupted dorso-central lines. Several specimens of both sexes were taken feeding on *Leptospermum* sp.

The holotype male and allotype female have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS FASCIPENNIS, n. sp.

Pelecorhynchus sp., Nicholson, 1927, p. 57, pl. ii, fig. 22.

A wasp-like species, with rather elongate, parallel-sided, black body, and with orange-yellow wings, which are marked by a broad, transverse, black band.

♂, ♀. Basal segments of antennae black, third segment bright orange. Eyes narrowly separated in the male, separated by about two-thirds of the length of the relatively short frons in the female. Frons and face dark grey, the frons darker, both with black hairs. Parafacials creamy-white, with silvery to pure white hairs. Ruff black, with an admixture of hoary hairs.

Scutum dark grey, the tomentum very inconspicuous. The dorso-central lines are a paler grey, and, though not conspicuous, are clearly defined throughout the length of the scutum; parallel as far as the suture, they converge markedly posteriorly. There is

a median black vitta, and one on each side bordering the dorso-central lines on their medial aspects; at a variable distance behind the suture, these lines become confluent, so that the whole median area is black posteriorly. Post-sutural sublateral areas with a narrow brown stripe. Scutal hairs black, marginal and supra-alar pubescence hardly differentiated. Scutellum grey, with a broad, brownish-black, median vitta; infra-scutellar tuft black in middle, white at sides. Post-mesopleural prominence covered with velvety black tomentum, and bearing black hairs; post-mesopleural tuft greyish-white. Legs black, tibiae brownish towards apex, all tarsi bright orange-brown. Wings bright orange; base, apex, and a narrow posterior zone black, and a complete, broad, transverse black band across the middle of the wing.

Abdomen shining black, with black hairs; marginal pubescence very dense, white to greyish in colour.

♂ hypopygium (Text-fig. 65): The ninth tergite is excavated to form a fairly deep, three-sided bay. The dorsal lobe of the gonocoxite forms a rounded hood. The style has a long, pointed lateral lobe, smaller medial lobe, and larger, rounded intermediate lobe, somewhat as in *P. tillyardi* Tayl. The aedeagus is peculiar, in that the distal part is more rounded than usual, and the hooks take the form of small, proximally directed spines; there is no spine on their medial side, and the space between the hooks is wide.

Length: 13 to 16 mm.

Distribution.—New South Wales: Wentworth Falls, 21.xii.1923 (Harrison), and 11.xii.1926 (Mackerras); Woodford, 7.xi.1926 (Mackerras); National Park, no date.

P. fascipennis, nov. is a striking and interesting species, which serves as a link between the very aberrant *P. tillyardi* Tayl. and the more normal forms. The very slight development of pubescence and tomentum is an unusual feature. It is separated from *P. taeniatus*, nov. as indicated under that species, and from *P. deuqueti* Hardy and *P. flavipennis* Ferg. by the banded rather than spotted wings and by the scutal markings. This species is a general wasp mimic, but is not especially deceptive in the field; it has been illustrated in colour from this point of view by Nicholson (1927). The few specimens taken hitherto have been captured while feeding on *Leptospermum flavescens*, Sm. but others were seen at Wentworth Falls sheltering under a high ledge of rock.

The holotype ♂ from Wentworth Falls (Harrison) and the allotype ♀ from Woodford have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS TAENIATUS, n. sp. Pl. i, fig. 4.

♂, ♀. Closely allied to *P. fascipennis*, nov., from which it differs as follows: The ruff is almost entirely white. There is a considerable admixture of white hairs at the margin of the scutum and in the post-alar tuft, and there are a few orange supra-alar hairs. The femora are reddish-brown, and the tibiae and tarsi are bright orange. The wing lacks the dark band close to the base. The abdomen bears orange instead of greyish hairs. The genitalia of the two species are very similar.

Length: 17 mm.

Distribution.—New South Wales: Alpine Creek, near Kiandra, 2.i.1932 (Willings, ♂), and 26.i.1935 (Campbell, ♀).

This species was taken feeding on *Leptospermum* sp. The holotype male and allotype female have been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS DEUQUETI Hardy.

Pelecorhynchus deuqueti Hardy, 1920, p. 38, pl. ix, fig. 7; Nicholson, 1927, p. 57, pl. ii, fig. 16; Enderlein, 1925, p. 262; Hardy, 1940, p. 486.

An ornate species, allied to *P. fascipennis*, nov. Scutum dark fawn, with yellow dorso-central lines and black markings; legs yellowish-brown; wings orange, black spotted; abdomen dark brown.

♂, ♀. Basal segments of antennae black, the third segment orange. Eyes narrowly separated in the male, separated in the female by the length of the frons. Frons and face with brown tomentum, and black hairs; parafacials silvery, with white hairs, mixed with a variable number of black hairs; ruff hoary.

Median and sublateral areas of scutum covered with dark fawn tomentum; dorso-central lines bright mustard-yellow, continuous to the scutellum, but widening and fading somewhat posteriorly; median area with a narrow black median vitta extending throughout its length and widening in front of the scutellum; sublateral areas divided by a broad, irregular, longitudinal black stripe, which is interrupted by the grey sutural line. Hairs of disc and margins black, the marginal and supra-alar pubescence relatively little developed, particularly in the female. Scutellum grey, with a broad black median stripe; infra-scutellar tuft black in centre, silvery to hoary at sides. Post-mesopleural prominence covered with conspicuous velvety black tomentum and black hairs; post-mesopleural tuft light grey. The remaining pleural sclerites are grey and bare, except the upper part of the mesepisternal area anteriorly, which is also covered with black tomentum. Legs entirely bright yellowish-brown, the femora being slightly darker than the other segments. Wings bright orange-yellow, with the posterior margin suffused with black, and with three series of black spots extending transversely across the distal half of the wing. These spots vary somewhat in different specimens, but are always conspicuous.

Abdomen shining brownish-black, with bright yellowish-brown pubescence, which gives the whole dorsum of the abdomen a distinctly brown appearance to the naked eye; the marginal pubescence is fairly dense and of the same colour. Contrary to what one usually finds, the abdomen of the female is slightly, though distinctly, more hairy than that of the male.

♂ hypopygium: Resembles that of *P. fascipennis*, nov., differing from it in the following respects: The ninth tergite is rather short and broad, and its distal edge is of the normal, gently concave form. The dorsal, hood-like lobe of the gonocoxite is larger and more acuminate apically; the intermediate lobe of the style is slightly larger, and projects a little beyond the medial lobe; the terminal hooks of the aedeagus are slightly larger.

Length: 15 to 16.5 mm.

Distribution.—New South Wales: Blackheath, xii.1918 (Deuquet, type female); Wentworth Falls, 21.xii.1923 (Nicholson), 11.xii.1926 (Mackerras), and 11.xii.1931 (Taylor); Mt. Kosciusko, no date (coll. Froggatt); Sydney, 1906 (Brown, coll. Froggatt).

P. deuqueti Hardy is a very distinctive species, which can be confused only with *P. flavipennis* Ferg., from which it is to be distinguished by the fawn median area of the scutum and other points listed under that species. It has hitherto only been taken feeding on *Leptospermum* sp. It is an active and conspicuous species, which has a considerable general wasp-like appearance, as noted by Nicholson (1927), who has also illustrated it in colour.

The allotype male (this sex not having been previously described), from Wentworth Falls, 11.xii.1926, has been deposited in the Macleay Museum, University of Sydney.

PELECORHYNCHUS FLAVIPENNIS Ferguson.

Pelecorhynchus flavipennis, Ferguson, 1921a, p. 3, pl. i; Hardy, 1940, p. 486.

♂, ♀. Closely allied to *P. deuqueti* Hardy, from which it is to be distinguished by the entirely black scutum, with conspicuous yellow dorso-central lines; by the bicolorous legs, the femora being black and the remaining segments flavid; and by the entirely black pubescence of the abdomen. The genitalia are similar in the two species, but the medial lobe of the style is rather larger and more rounded in *P. flavipennis* Ferg. than in *P. deuqueti* Hardy.

Length: 16 mm.

Distribution.—Victoria: Ferntree Gully, 10.xii.1904 (type ♂); Launching Place, 21.i.1908 (type ♀). New South Wales: Alpine Ck., near Kiandra, 2.i.1932 (Willings); Diggers Ck., Mt. Kosciusko, 5,000 ft., 23.i.1929 (F. Tillyard).

It has been taken on *Leptospermum* sp., and its habits are similar to those of its allies.

PELECORHYNCHUS TILLYARDI Taylor. Pl. i, fig. 7.

Pelecorhynchus tillyardi, Taylor, 1918, p. 54; Hardy, 1920, p. 37, pl. ix, fig. 6; Surcouf, 1921a, p. 222; Enderlein, 1925, p. 262.

A black, relatively slender species, with an elongate, parallel-sided abdomen. Scutum black, with grey median area; wings dark smoky brown.

♂, ♀. Antennae with basal segments and base of third segment black, greater part of third segment orange-yellow, tip black. Eyes touching in male, widely separated in female. Frons of female almost square, widening towards the antennae; dark grey, with black hairs. Face dark grey, with hoary areas and black hairs. Parafacials silvery-grey, with black hairs. Ruff black.

Scutum with median area largely grey and bare, sublateral areas and markings of median area covered with velvety black tomentum. Dorso-central lines, narrow, complete, pale grey, their medial edges inconspicuous. Median area with a continuous black, central vitta, and a broader, short, black vitta on each side extending forward from the scutellum for about one-fourth of the scutal length. Scutellum black. Scutal, marginal, supra-alar, and infra-scutellar pubescence entirely black. Post-mesopleural hairs and tuft black. Squamal tuft ashy. Legs entirely black. Wings dark smoky brown, suffused with still darker brown on the whole length anteriorly.

Abdomen black, with diffuse sublateral grey patches of variable extent on the first and second visible tergites; abdominal pubescence largely black, grey to white on the paler areas. Lateral margins with white hairs on the first visible segment, and with mixed black and white hairs on the other segments, the black completely replacing the white posteriorly. In one of the females, the sides of the abdomen are almost entirely white haired.

♂ hypopygium (Text-fig. 66): The ninth tergite and eighth sternite are short and broad, and the distal edge of the tergite is excavated to form a three-sided bay, much as in *P. fascipennis*, nov., but more definitely rectangular. The dorsal lobe of the gonocoxite is relatively narrow, and is evenly rounded distally. The lateral lobe of the style is long and finger-like, the medial is short and bluntly rounded, and the intermediate is rounded and markedly larger than the medial. The basal part of the aedeagus is very broad; the hooks are narrow and strongly upturned, and the space between them is considerably narrowed; the spines on their medial aspects are prominent, and the space proximal to the spines is but slightly expanded. The general appearance of the clasping and intermittent organs is more like that of the *personatus* group than of other members of the *fusciger* group.

Length: 13 to 15 mm.

Distribution.—New South Wales: Dorrigo, 20.xi.1911 (Tillyard, type locality); Barrington Tops, 7.ii.1925 (S.U. Zool. Exped.).

P. tillyardi Tayl. is strikingly different from all except *P. niger*, nov., which is described below. Besides being structurally aberrant, these two species are very peculiar in their habits. They have not been seen in flight, and were taken at Barrington Tops feeding on *Leptospermum* flowers. They clung closely to the flowers and crawled about very slowly with their wings folded straight back along the abdomen, the whole appearance being that of a long-bodied beetle rather than a fly.

The allotype male, from Barrington Tops, has been lodged in the Macleay Museum, University of Sydney.

PELECORHYNCHUS NIGER, n. sp.

♂, ♀. A narrow-bodied, black species like *P. tillyardi* Tayl., from which it differs as follows: The ruff, supra-alar tuft, and pubescence at the side of the scutum are rich orange-red in colour, darker in ♀; the post-mesopleural tuft is orange-red in ♂, brilliant white in ♀. Scutum entirely black, with prominent, narrow, grey dorso-central lines, which fade posteriorly and disappear a little in front of the scutellum. The wings are distinctly darker than in *P. tillyardi* Tayl. The abdomen is similar, except that the paler areas on the first and second visible tergites are very inconspicuous.

♂ hypopygium: Similar to that of *P. tillyardi* Tayl., but the excavation at end of the ninth tergite more rounded; basal part of aedeagus not quite so broad, spines not so prominent, and the intermediate lobe of the style somewhat larger and more rounded.

Length: 13 mm.

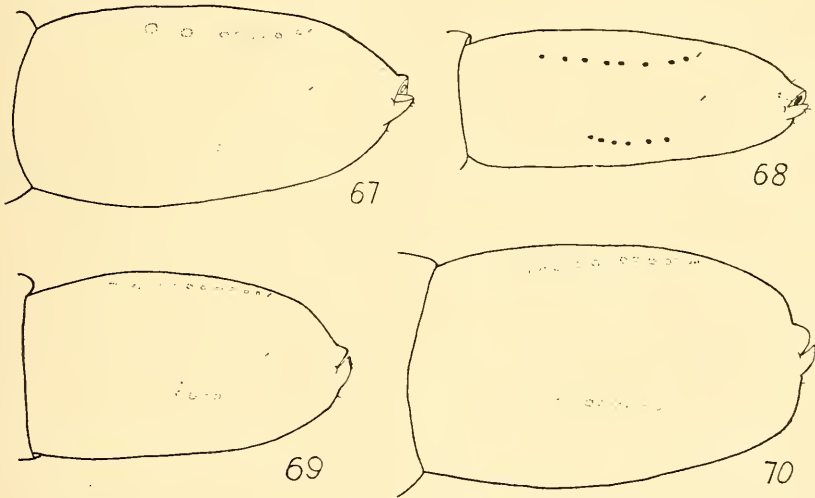
Distribution.—New South Wales: Mt. Irvine, no date (Plomley, 1 ♂); Barrington Tops, 7.ii.1925 (S.U. Zool. Exped., 1 ♀); Helensburgh, 1910 (Brown, 1 ♀) (coll. Froggatt).

The holotype male, from Mt. Irvine, is in the collection of the School of Public Health and Tropical Medicine, University of Sydney; the allotype female, from Barrington Tops, has been lodged in the Macleay Museum, University of Sydney.

C. THE EARLY STAGES OF SOME AUSTRALIAN SPECIES.

P. nigripennis Ric. Text-figs. 68, 71.

Larva.—The length of the larvae collected varied from 35 to 52 mm. They are considerably more slender, more delicate in appearance than *P. fulvus* Ric., and the skin is more transparent and whiter. They are easily distinguished by the shape of the last segment which is narrower and more elongate, parallel-sided and pointed at the end than in *P. fulvus* Ric. and *P. rubidus*, nov. The gland openings are more conspicuous than in the other two species, being coloured a smoky brown. The longitudinal rows on the last segment are particularly noticeable. There are fewer dots in the dorso- and more in the ventro-lateral rows than in *P. fulvus* Ric., and the individual dots are smaller. The spiracular cavern is wider, the lips are outlined with a light brown line, and the fringes are longer than in *P. fulvus* Ric. The spiracular plates are larger and more heavily chitinized, the whole plate, except the row of openings on each side, being black. This character is useful to distinguish *P. nigripennis* Ric. in the field. There is a black mass on the inside of the bottom lip at its base, and the six gland openings at the junction of the lips (bottom of the cavern) are also black.



Text-figs. 67-70.—Terminal segments of larvae. 67. *P. fusconiger* Walk. 68. *P. nigripennis* Ric. 69. *P. fulvus* Ric. 70. *P. rubidus*, n. sp.

The ventral thoracic hairs are considerably longer than in *P. fulvus* Ric., projecting well out from the surface. There are three long hairs and one short hair in each group. The little hairs on the first and last segments are also long. The larva is slightly more constricted between the segments, the junction between them being marked by a more obvious brown line. The anterior spiracles are larger than in *P. fulvus* Ric., have about ten openings, and are visible with the naked eye as brown spots.

The whole head is rather smaller and narrower than in *P. fulvus* Ric. The mouth parts are similar in detail, the only slight difference being seen in the spines of the spinose area which are rather longer and more slender.

Pupa.—The pupa of the female is about 28 mm. long, more slender than that of *P. fulvus* Ric., resembling rather the male pupa of that species. The chitin of the thorax is smoother, with no rugose region on the vertex as in *P. fulvus* Ric. The bristling of the thorax is similar, as also is the thoracic spiracle.

The abdominal spiracles are raised on more elongate mounds, are smaller, and more of a closed horse-shoe shape on the later segments. The girdles of spines are more

flattened, wider and thorn-like. They are reduced in size on the ventral surface, and very reduced, both dorsally and ventrally on the first three segments. They have longer, sharper points than those of *P. fulvus* Ric. The four big central spines are more appressed to the surface, are broader and very thorn-like. The ventral pair is absent, and represented by two minute chitinous dots. The six points of the aster are shorter and more curved and the dorsal pair bear a pair of smaller subsidiaries laterally. The postero-ventral prominence is blunter and its two lateral projections more rounded.



Text-figs. 71-73. End view of terminal segment of pupae. 71. *P. nigripennis* Ric.
72. *P. rubidus*, n. sp. 73. *P. fusconiger* Walk.

In the male, the anal knob is very enlarged, and the pair of papillae behind it more prominent than in *P. fulvus* Ric. The subsidiaries on the dorsal arms of the aster are absent, and the area between the aster and the prominence is swollen instead of flat as in the female. The male pupa is shorter than the female, but not more slender.

P. rubidus, n. sp. Text-figs. 70, 72.

Larva.—The smallest larva collected measured 40 mm. in length, and the largest 59 mm., with every gradation between. The larva is not only longer than that of *P. fulvus* Ric., but has a greater girth, being noticeably thicker and more robust. It is readily distinguished from *P. fulvus* Ric. in having the last segment tinged orange, the colour deepening towards the extremity at the spiracular cavern, the lips of which are strongly pigmented, especially the lower, which is almost brown.

The anterior spiracles have six or seven instead of three slits, and the posterior spiracles are rather larger and more elongate than in *P. fulvus* Ric. The thoracic hairs and the other small hairs on the first and last segments are comparatively more minute than in *P. fulvus* Ric. The hairs on the lower lip of the cavern, and the fringes inside the lips are also noticeably shorter and smaller. The mouth parts are the same in structure and detail, except that the teeth on the labrum are longer and more distinct, and the head itself is more elongate and larger. The gland openings are paler and less conspicuous. The longitudinal rows of dots on the last segment vary in number as in *P. fulvus* Ric., but are usually more, eleven to thirteen dorso-laterally, and six to eight ventro-laterally. The ventro-lateral row is sloping instead of relatively straight as in *P. fulvus* Ric.

Pupa.—The female pupa is 37 mm. long, and has a smooth thorax, lacking the rough area on the vertex, as in *P. nigripennis* Ric. The thoracic spiracle is comparatively smaller, with the slit shorter and wider. The girdles of spines are well developed, even on the first and second segments where they are usually reduced. They are not so closely set as in *P. fulvus* Ric., but they are much longer with very sharp, long points. The four central dorsal spines are long, but the ventral pair is represented only by two dots. The abdominal spiracles are large, with the slits dark brown instead of pale as in *P. fulvus* Ric. The scroll is wide, with the more posterior spiracles having the ends almost meeting, forming a complete oval.

The six points of the aster are very long and sharp at the tip, and slightly curved inwards. The dorso-lateral pair is very close to the dorsal pair, with a big gap to the latero-ventral pair. The prominence with its two lateral points is elongate. The anus is small. The male pupa is smaller, with the pair of anal papillae closer to the anus than in the other species. The lateral points of the prominence are narrower than in the female.

P. fulvus Ric. Text-figs. 49, 69.

Larva.—The larva has been described in detail above (pp. 18-23). The smallest measured 13 mm. in length and the largest 52 mm., with all gradations between. The full-grown larva is robust, but not as thick as *P. fusconiger* Walk. or *P. rubidus*, nov. It is shining translucent white to pale apricot in colour. The thoracic hairs and those on the last segment are minute and short, scarcely projecting above the surface. They are slightly shorter than in *P. fusconiger* Walk. and longer than in *P. rubidus* nov. The transverse rows of gland openings on the abdominal segments are not very conspicuous, being only slightly more coloured than the surrounding integument. The longitudinal rows on the last segment are larger, but pale and inconspicuous. There are eight to ten dots in the dorso- and five to seven in the ventro-lateral row.

The anterior spiracles are very small, with three slits in each. The posterior spiracles are brownish-yellow and fairly large. The spiracular cavern is relatively small, and seems incapable of opening very widely as in some of the other species. The larva of *P. fulvus* Ric. most closely resembles that of *P. fusconiger* Walk.

The pupa.—The average length of the female pupa is 30 mm. Its most distinctive feature is the rugosity of the vertex and back of the head. The abdominal spiracles are raised on small mounds, and the slit is scroll-shaped. The girdle of spines around each segment is composed of closely set, strong, broad and sharp spines. They vary in size, some bearing two or three subsidiary spinelets. The aster has small accessory spines on and between the arms.

P. fusconiger Walk. Text-figs. 67, 73.

Larva.—The length is 34 to 53 mm. It is very similar in appearance to *P. fulvus* Ric., but is thicker and more robust, like *P. rubidus*, nov. The integument is coloured the same as the lighter *P. fulvus* Ric., no larvae of lemon or apricot tints being found. There is no pigmentation on any of the segments. The anterior spiracles are larger, with five to six openings, and the thoracic hairs and the fringe inside the lips of the spiracular cavern are slightly longer than in *P. fulvus* Ric. The mouth parts and posterior spiracles are like those of *P. fulvus* Ric., as are the rows of dots on the last segment, except that the ventro-lateral row has usually fewer dots, about three to six.

Pupa.—This also resembles *P. fulvus* Ric., but is smaller, the female being only 28 mm. long. The vertex and head are smoother, and the slit of the thoracic spiracle is slightly shorter and wider. The spines in the abdominal girdles are shorter and smaller, and, as in *P. fulvus* Ric., the ventral pair of central spines on each segment is well developed. The aster is very like that of *P. fulvus* Ric., but there are no subsidiaries on or between the six points, the dorsal and dorso-lateral arms are closer, and the projections of the posterior ventral swelling are shorter and rounder.

D. THE SOUTH AMERICAN SPECIES.

Key to the Species.

1. Uniformly reddish-brown species, without scutal vittae or abdominal markings *vulpes* (Macq.)
Black species, with conspicuous, pale dorso-central lines on the scutum 2
2. Pale abdominal markings inconspicuous, especially on the venter; wings russet-orange ... 3
Abdomen with conspicuous white markings dorsally and ventrally; wings only suffused anteriorly with yellow or orange 4
3. Ruff and pleural hairs black *longicaudus* (Bigot)
Ruff and pleural hairs yellow *xanthopleurus* (Phil.)
4. White spots on dorsum of abdomen restricted to the fourth, and sometimes also the third, visible tergite *biguttatus* (Phil.)
Conspicuous white spots present on the second and third, as well as the fourth, visible tergites 5

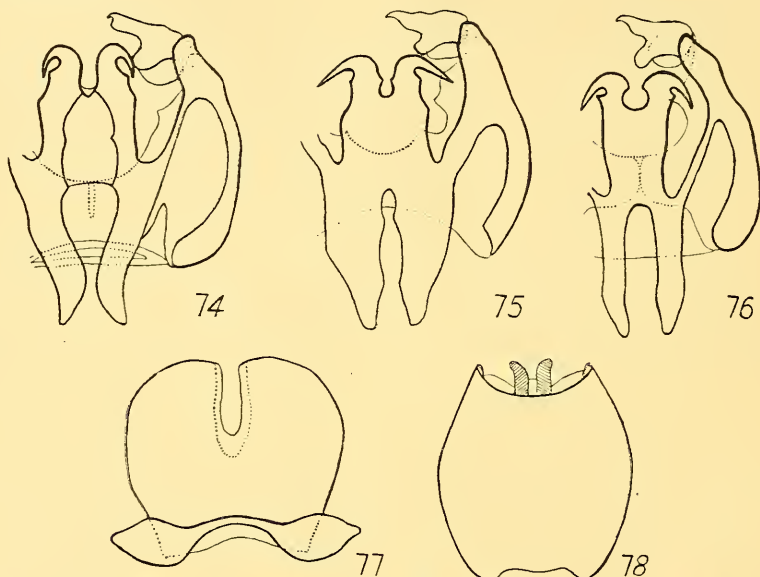
5. Legs black *elegans* (Phil.)
 Legs reddish-brown *kröberi* (Lind.)

PELECORHYNCHUS VULPES (Macquart).

Pangonia vulpes Macquart, 1850, p. 23.—*Pelecorhynchus aurantiacus* Ricardo, 1900, p. 103, pl. i, fig. 2, 1910, p. 409.—*Pelecorhynchus vulpes* (Macq.), Surcouf, 1921a, p. 222, 1921b, p. 111.—*Coenura vulpes* (Macq.), Enderlein, 1925, p. 262; Kröber, 1930, p. 114.

A reddish-brown species, with orange-yellow ruff and pleural hairs, except the post-mesopleural tuft, which is white. The scutum is covered with orange-rufous hairs, which are very deep in colour on the sides and on the scutellum. The legs are yellow, with red hind tibiae. The wings are hyaline, yellow at base and along the fore border. The abdomen is covered with dense, orange-rufous pubescence.

Distribution.—Chile: No locality (Macquart, Ricardo); Concepcion, Valdivia, Coquimbo (Kröber).



Text-figs. 74-78.—Male hypopygia of Chilean species. 74. *P. longicaudus* Bigot. 75. *P. biguttatus* Phil., and *P. elegans* Phil., narrow form. 76. *P. elegans* Phil., broad form. 77. Eighth sternite and tergite of *P. longicaudus* Bigot. 78. Ninth tergite and cerci of *P. longicaudus* Bigot.

PELECORHYNCHUS LONGICAUDUS (Bigot). Pl. i, fig. 2.

Coenura longicauda Bigot, 1857, p. 287, pl. vi, fig. 2; Philippi, 1865, p. 726; Enderlein, 1922, p. 336, 1925, p. 262; Kröber, 1930, p. 113.

♂, ♀. A black species, with conspicuous yellow dorso-central lines and uniformly russet-orange wings. The ruff, infra-scutellar tuft, and all the pleural hairs are jet black, with the exception of the squamal tuft, which is rich orange in colour. The halteres are also orange, and stand out conspicuously against the black background. The legs are black, pulvilli orange. The abdomen is bare, except for inconspicuous, greyish-white, sublateral patches of thin tomentum on the second, third, and sometimes fourth visible tergites. The venter is shining black, with inconspicuous sublateral patches of thin greyish-white tomentum on one or two of the basal segments. The legs are black.

♂ hypopygium (Text-figs. 74, 77, 78): The ninth tergite is large, with its distal edge somewhat excavated. The ninth sternite is short, broad, and deeply cleft distally, but without thumb-like projections. The dorsal lobe of the gonocoxite is not expanded, and is evenly rounded. The style is relatively strong and dark; its lateral lobe is hooked at the tip, the medial lobe is small, and the intermediate lobe projects beyond the medial. The hooks of the aedeagus are strong, and are proximally and somewhat laterally curved.

The space between them is evenly curved, devoid of spine, and not expanded proximally; it shows distinct variation in width in different specimens.

Distribution.—Chile: No locality (Bigot); Parral, Province of Colcaagua (Philippi); Yungay, 13.i.1930 (Stuardo), 2 ♂♂, 1 ♀; no locality, 1.xii.1921 (F. Ruiz), 2 ♂♂ (ex coll. Stuardo).

This species is the genotype of Bigot's genus *Coenura*. It is a true *Pelecorhynchus*, and its relationships have been discussed above (p. 26). It is to be distinguished from the Australian *P. interruptus*, nov. by its more slender form, continuous scutal vittae, and male genitalia, and from the other Chilean species by the entirely black ruff and pleural hairs and rudimentary abdominal spots. The most remarkable feature of *P. longicaudus* Bigot is the short proboscis and greatly reduced mandibles of the female (Text-fig. 4), but these characters are of phylogenetic rather than taxonomic interest. The ovipositor, fully extended in Bigot's specimen, is normally retracted in the females before us, and only the cerci are visible.

PELECORHYNCHUS XANTHOPLEURUS (Philippi).

Coenura xanthopleura Philippi, 1865, p. 726; Enderlein, 1925, p. 262; Kröber, 1930, p. 116.

This species appears to be most closely allied to *P. longicaudus* Bigot, from which it is to be distinguished by the yellow ruff and pleural hairs. The description makes no mention of white fasciae on the venter, and presumably these are absent; if they are present, it will have to be placed near *P. biguttatus* Phil., from which it may be separated by the more uniformly flavid wings and inconspicuous abdominal spots.

Distribution.—Chile: Province of Valdivia, xii.1859 (Philippi), type locality.

PELECORHYNCHUS BIGUTTATUS (Philippi).

Coenura biguttata Philippi, 1865, p. 726; Enderlein, 1925, p. 262; Kröber, 1930, p. 115.—

Pelecorhynchus darwini Ricardo, 1900, p. 102, pl. i, fig. 1, 1910, p. 408; Surcouf, 1921a, p. 222; Surcouf, 1921b, p. 111.—*Coenura darwini* (Ric.), Enderlein, 1925, p. 262.

Related to *P. elegans* Phil., described below, but the dorso-central lines of the scutum are distinctly narrower, and the abdominal spots are absent on the second visible tergite, rudimentary or absent on the third, and small on the fourth; the white bands on the venter are much narrower, more widely interrupted, and inconspicuous posteriorly. In the specimen before us, the ruff and pleural hairs are rich orange-yellow, with the post-mesopleural tuft distinctly paler in its distal part as in some specimens of *P. elegans* Phil.; the infra-scutellar tuft is pale gold.

♂ hypopygium (Text-fig. 75): The ninth tergite is very short and broad, and somewhat less excavated distally than in *P. longicaudus* Bigot. The gonocoxite is similar, but the style is less robust, and its lateral lobe is shorter and not so strongly hooked distally. The hooks of the aedeagus are longer, more slender, and less proximally directed, making an angle of about 45° with the sagittal plane; the space between them bears distinct spines, proximal to which it is expanded to an almost circular form.

Distribution.—Chile: Province of Valdivia (Philippi), type locality; Chiloë and Concepcion (Ricardo); Santo Domingo, Futa, Valdivia, Chiloë, Ins. Puerto Montl (Kröber); Peulla, 9.i.1933 (Stuardo), 1 ♂.

Of this species Philippi writes: "On the forest road between San Domingo and Futa these beautiful flies hovered two or three feet over the ground without settling; if I approached they darted away like an arrow and then came back again to the same spot." The similarity to the habits of many Australian species, for example, *P. fusconiger* Walk., hardly needs comment. Kröber sinks *P. darwini* Ric. as a synonym, an action which appears to be fully justified.

PELECORHYNCHUS ELEGANS (Philippi).

Coenura elegans Philippi, 1865, p. 727; Enderlein, 1925, p. 262; Kröber, 1930, p. 116. pl. iv, fig. 1.—*Coenura albopunctata* Schiner, 1868, p. 77; Enderlein, 1925, p. 262; Kröber, 1930, p. 116.

♂, ♀. A black species, with conspicuous yellowish dorso-central lines, and greyish hyaline wings clouded anteriorly and basally with orange. Ruff, lateral hairs of

mesonotum, and pleural hairs orange to creamy-yellow in different specimens, but always darker and richer in colour above than below; the distal part of the post-mesopleural tuft and the squamal tuft are paler than the rest, sometimes almost creamy-white; the suprasquamal tuft is particularly prominent in this species; infra-scutellar tuft bright pale gold. Abdomen black, bare in part, but with rudimentary transverse zones of black tomentum, and with conspicuous white tomentose spots on the second and third visible tergites; on the fourth tergite there is a broad transverse white fascia, which is interrupted by a narrow median black vitta; there is also a small white basal spot at the lateral edge of the second and third tergites. Venter black, with three broad white fasciae, the anterior two widely interrupted in the mid-line, and the posterior slightly notched. Legs black; femora with rather dense hairs, which have a silvery sheen in certain lights; fore tibiae with golden reflections ventrally.

♂ hypopygium: Closely similar to that of *P. biguttatus* Phil. (Text-fig. 75), but the ninth tergite is sometimes not quite so broad, the hooks of the aedeagus may be somewhat shorter and stouter, and, as in *P. longicaudus* Bigot, the width of the space between them is variable. Three specimens were available for dissection; in one the space was very slightly wider than in *P. biguttatus* Phil., in another (Text-fig. 76) it was markedly broader, and the third was intermediate.

Distribution.—Chile: Llico (Philippi), type locality; Concepcion, 30.xii Coronel, 15.xii Llico, Canquenes (Kröber); Huingan, 12 & 19.i.1925 (F. Ruiz), 3 ♂♂, 4 ♀♀ (ex coll. Stuardo).

This species is readily recognized, and is aptly named. It may be noted that the proboscis is normal, and the mandibles are similar to the Australian *P. distinctus* Tayl. (Text-fig. 5). One of the males before us agrees very well with Kröber's (1930) redescription of the type of *C. albopunctata* Schin. It so happens, too, that it is this specimen which has the widest space between the hooks of the aedeagus (Text-fig. 76); but others are intermediate both in structural characters and colouration, and we have no doubt that Schiner's name should fall to synonymy. As regards habits, Kröber quotes F. W. Edwards' note as follows: "We obtained numerous specimens of each sex of this species in early morning (7 to 9 a.m.) at flowers of a Saxifragaceous plant (*Escallonia pulverulenta*), in company with *Oscia lata* and *O. rufa*."

PELECORHYNCHUS KRÖBERI (Lindner).

Cocnura kröberi Lindner, 1925, p. 23; Kröber, 1930, p. 115.

A handsome species, related to *P. elegans* Phil., from which it differs in the white ruff and pleural hairs, in the golden-brown infra-scutellar tuft, and especially in the legs, which are red-brown, darkening distally on the tarsi. The white abdominal markings are more extensive, and there is a pair of spots on the first visible tergite, a character which is not present in any of the other species.

Distribution.—Chile: Punta Arenas, 1908, Pässler (Lindner), type locality.

Catalogue of the Species.

PERSONATUS group.	Page.
<i>personatus</i> (Walker 1848)	47
(<i>maculipennis</i> Macquart 1850)	
(<i>maculipennis</i> Thomson 1868)	
(<i>ornatus</i> Schiner 1868)	
<i>nigripennis</i> Ricardo 1910	48
<i>olivei</i> Hardy 1933	49
<i>igniculus</i> Hardy 1917	50
<i>albolineatus</i> Hardy 1917	51
<i>eristaloides</i> (Walker 1848)	52
<i>kippsi</i> , n. sp.	52
<i>montanus</i> Hardy 1916	53
<i>occidens</i> Hardy 1933	54
<i>rubidus</i> , n. sp.	54
<i>rubidus</i> var. <i>avittatus</i> , n. var.	55
<i>simplex</i> , n. sp.	55
<i>simplissimus</i> , n. sp.	56

Fulvus group.	Page.
<i>fulvus</i> Ricardo 1910	56
<i>mirabilis</i> Taylor 1917	58
<i>distinctus</i> Taylor 1918	59
FUSCONIGER group.	
FUSCONIGER series.	
<i>fusconiger</i> (Walker 1848)	60
<i>fusconiger</i> var. <i>rufibasis</i> , n. var.	61
<i>fusconiger alpinensis</i> , n. subsp.	61
<i>fusconiger fergusonii</i> Hardy 1939	62
<i>nero</i> , n. sp.	62
<i>claripennis</i> Ricardo 1910	63
<i>nebulosus</i> , n. sp.	63
<i>lineatus</i> , n. sp.	64
<i>interruptus</i> , n. sp.	65
FASCIPENNIS series.	
<i>fascipennis</i> , n. sp.	65
<i>laeniatus</i> , n. sp.	66
<i>deuqueti</i> Hardy 1920	66
<i>flavipennis</i> Ferguson 1921	67
TILLYARDI series.	
<i>tillyardi</i> Taylor 1918	67
<i>niger</i> , n. sp.	68
*VULPES series.	
<i>vulpes</i> (Macquart 1850)	72
(<i>aurantiacus</i> Ricardo 1900)	
*LONGICAUDUS series.	
<i>longicaudus</i> (Bigot 1857)	72
<i>xanthopleurus</i> (Philippi 1865)	73
<i>biguttatus</i> (Philippi 1865)	73
(<i>darwini</i> Ricardo 1900)	
<i>elegans</i> (Philippi 1865)	73
(<i>albopunctata</i> (Schiner 1868))	
<i>kröberi</i> (Lindner 1925)	74

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EXPLANATION OF PLATE I.

1. *Pelecorhynchus nigripennis* Ric., female. 2. *P. longicaudus* Bigot, male. (The abdominal markings are unusually conspicuous.) 3. *P. rubidus*, n. sp., male. 4. *P. taeniatius*, n. sp., female. 5. *P. fulvus* Ric., female. 6. *P. fusconiger* Walk., female. 7. *P. tillyardi* Tayl., female.